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PEAT MARWICK MITCHELL AND CO SAN FRANCISCO CALIF F/G 1/2
SAN FRANCISCO INTERNATIONAL AIRPORT DATA PACKAGE NUMBER 4, AIRP--ETC(U)
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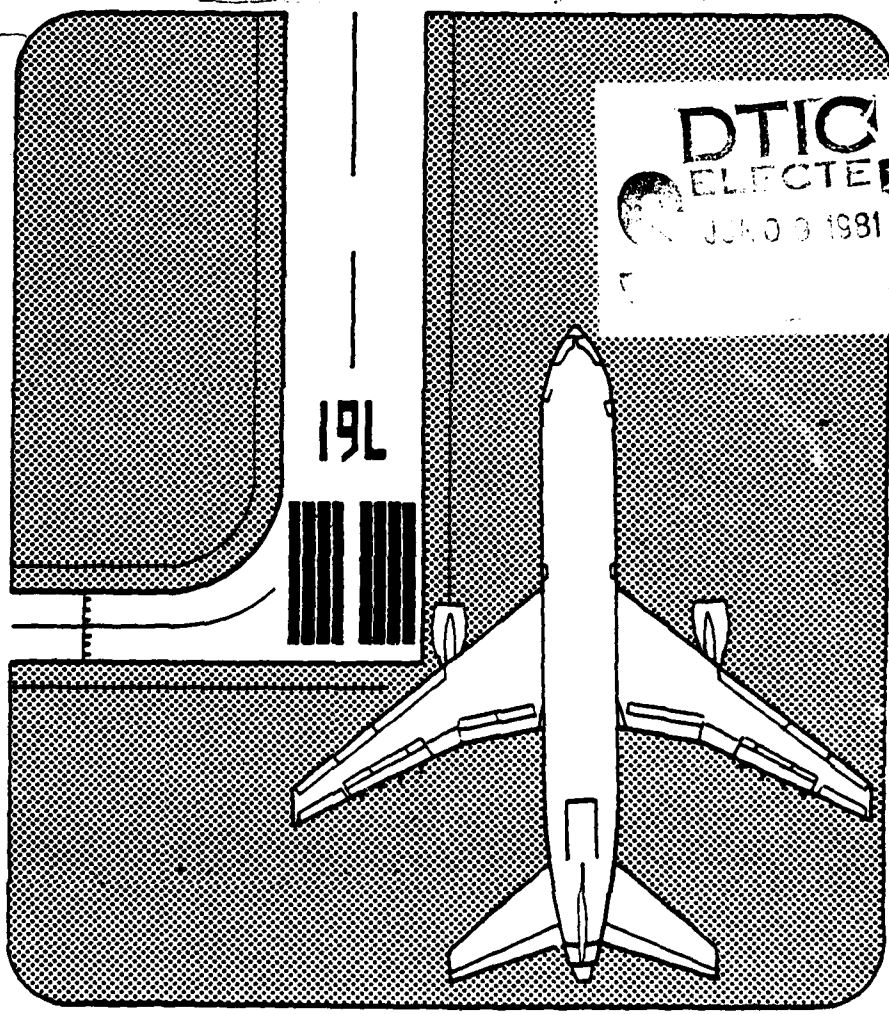
LEVEL III

**AIRPORT IMPROVEMENT
TASK FORCE DELAY STUDIES.**

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Peat, Marwick, Mitchell & Co.

MARCH 1979

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PEAT, MARWICK, MITCHELL & Co.

P. O. BOX 8007

SAN FRANCISCO INTERNATIONAL AIRPORT

SAN FRANCISCO, CALIFORNIA 94128

Telephone: (415) 347-9521

March 15, 1979

Mr. Michael M. Scott, ATF-4
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Re: San Francisco Data Package No. 4

Dear Mike:

Enclosed is Data Package No. 4 for San Francisco International Airport. The package contains the revised results of the Stage 1 delay experiments (Attachment A) and results of the Stage 2 airfield simulation model experiments (Attachment B).

These data should be reviewed by the San Francisco Task Force during the March 16, 1979, Task Force meeting.

Sincerely,

Sl ~ d Bl m

Stephen L. M. Hockaday
Manager

SLMH/nlm
Enclosure

cc: Mr. J. R. Dupree (ALG-312)
Mr. Royal Mink (AWE-4)

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Attachment A

RESULTS OF REVISED STAGE 1 DELAY EXPERIMENTS

San Francisco International Airport
Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

March 1979

Table A-1

STAGE 1 EXPERIMENTS
San Francisco International Airport
Airport Improvement Task Force Delay Studies

Experiment Number	Page Number	Model	Arrival Runways	Departure Runways	Weather	Demand	ATC Scenario	Near-Term Improvements
1		ASM	28L, 28R, 1L	1L, 1R, 28L	VFR 1	1977	Today	None
2		ASM	28L, 28R, 1L	1L, 1R, 28L	VFR 2	1977	Today	None
3	4	ASM	28R	1L, 1R, 28L	IFR 1	1977	Today	None
4		ASM	28L, 28R	28L, 28R	VFR 1	1977	Today	None
5		ASM	28R	28L	IFR 1	1977	Today	None
6		ASM	19L, 19R	10L, 10R, 19R	VFR 1	1977	Today	None
7	7	ASM	19L	10L, 10R	IFR 1	1977	Today	None
8	10	ASM	19L, 19R	19L, 19R	VFR 2	1977	Today	None
9	13	ASM	19L	19L, 19R	IFR 2	1977	Today	None
10	16	ASM	19L	19L, 19R	IFR 2	1977	Today	Extend Taxiways L and V
11		ASM	19L, 19R	10L, 10R, 19R	VFR 1	1977	Today	Extend 1L/19R, VASI on 19R
12		ASM	19L, 19R	10L, 10R, 19R	VFR 1	1977	Today	Extend Taxiway K, 10L/10R departs
13		ASM	28L, 28R	1L, 28L	VFR 1	1977	Today	Utility runway on Taxiway L
14	19	ASM	28L, 28R	1L, 28L	VFR 1	1977	Today	None
15		ASM	28L, 28R	28L, 28R	VFR 1	1977	Today	None
16		ADM	n.a.	n.a.	n.a.	1977	Today	None
17		ADM	n.a.	n.a.	n.a.	1977	Today	None
18		ADM	28L, 28R	28L, 28R	VFR 1	1977	Today	Utility runway on Taxiway C

Table A-2

DELAY SUMMARY
STAGE 1 AIRFIELD SIMULATION MODEL EXPERIMENTS

Experiment Number	Page Number	Weather	Demand	ATC Scenario	Experiment Description	Runway Delay (Minutes)					
						Arrivals			Departures		
						Max. Average	Average Daily ^a	Average Daily ^a	Max. Average	Average Daily ^a	Average Daily ^a
1		VFR1	1977	Today	Baseline	0.9	0.5	2.7	1.6		
2		VFR2	1977	Today	Baseline	4.3	1.2	3.3	1.8		
3	4	IFR1	1977	Today	Baseline	60+	53.5	10.7	3.2		
4		VFR1	1977	Today	Baseline	1.2	0.7	5.4	2.3		
5		IFR1	1977	Today	Baseline	60+	55.3	4.4	1.3		
6		VFR1	1977	Today	Baseline	2.5	0.9	5.9	2.9		
11					Extend 1L/19R, VASI on 19R	1.2	0.6	6.3	3.1		
12					Extend Taxiway K, 10L/10R Departs	2.6	0.9	2.5	1.6		
7	7	IFR1	1977	Today	Baseline	47.4	15.2 ^b	58.7	33.2 ^b		
8	10	VFR2	1977	Today	Baseline	4.2	1.1	8.4	3.2		
9	13	IFR2	1977	Today	Baseline	36.8	12.4 ^b	60+	48.0 ^b		
10	16				Extend Taxiways L and V	36.4	12.7 ^b	35.8	20.4 ^b		
14	19	VFR1	1977	Today	Baseline	1.0	0.7	4.2	2.4		
13					Utility Runway on Taxiway L	0.7	0.3	3.6	1.7		
15		VFR1	1977	Today	Baseline	16.9	7.7	5.8	3.1		
18					Utility Runway on Taxiway C	5.0	1.8	3.9	2.1		

a. 15-hour daily average (0600-2100) except as noted.

b. 7-hour daily average (0600-1300).

Experiment No. 3

Objective:

To obtain 1977 baseline delay estimates for the following runway use in IFR1 weather:

Arrival Runways

28R

Departure Runways

1L, 1R, 28L

Related Comparison Experiments:

None directly in Stage I.

Results:

Figure 3A shows that total aircraft flows vary from 9 to 63 aircraft per hour over the 15-hour simulation run. The peak hour is from 0900 to 1000 hours and contains 6 arrival aircraft and 7 departure aircraft.

Figure 3B shows that average delays to aircraft using the runways are as high as 60+ minutes per aircraft. Peak-hour average delays are 60+ minutes for arrival aircraft and 10.7 minutes for departure aircraft.

Figure 3C shows that the peak-period average delays to aircraft using the taxiways are 0.4 minutes for taxi-in operations and 0.3 minutes for taxi-out operations.

Figure 3D shows that average aircraft taxi travel times vary from 3.1 to 14.3 minutes. Peak-hour average taxi travel times are 5.3 minutes for arrival aircraft and 14.3 minutes for departure aircraft.

FIGURE 3A AVERAGE RUNWAY FLOW RATES

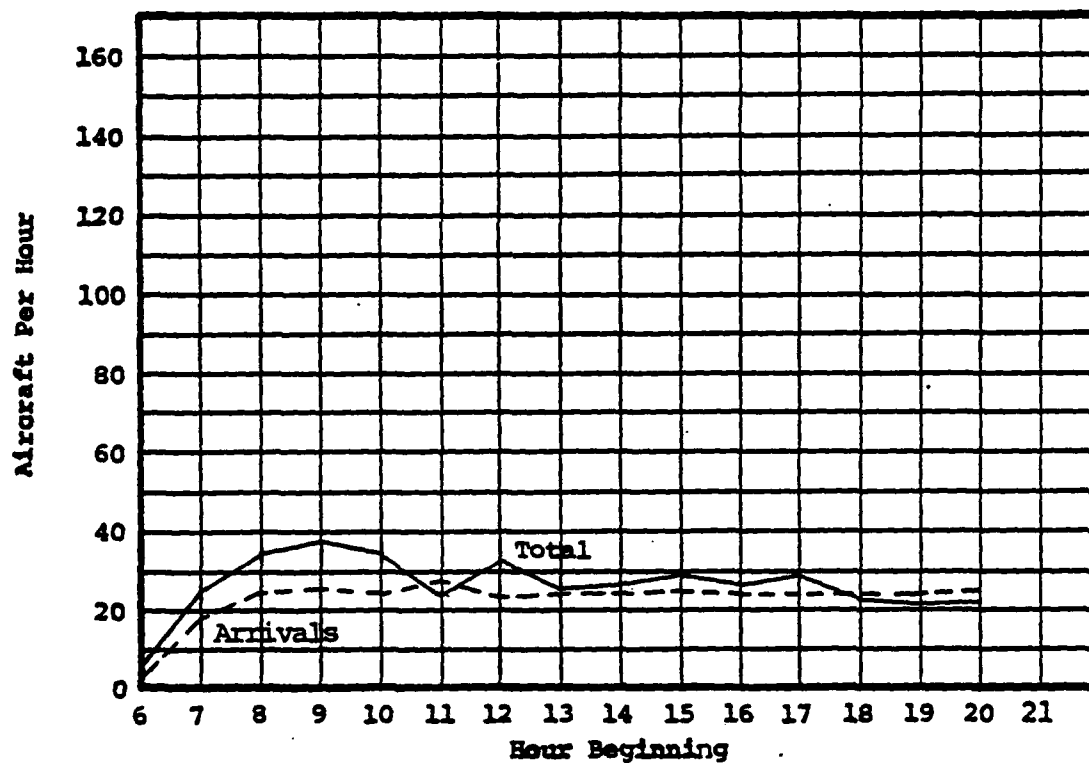


FIGURE 3B AVERAGE RUNWAY DELAYS

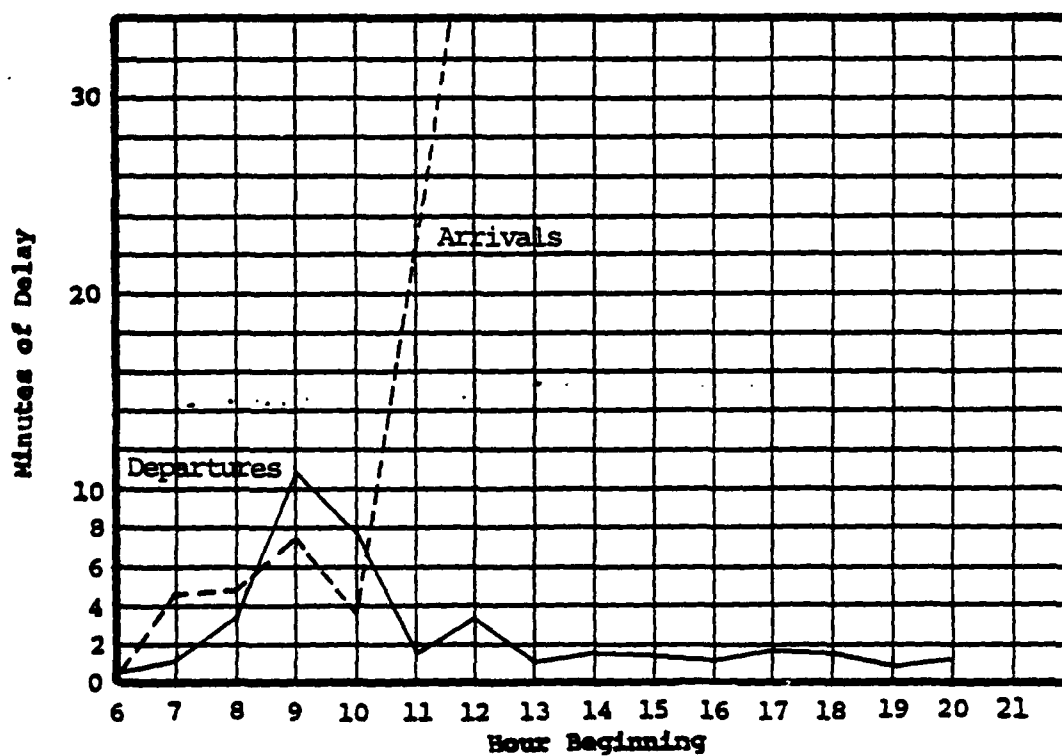


FIGURE 3C AVERAGE TAXIWAY DELAYS

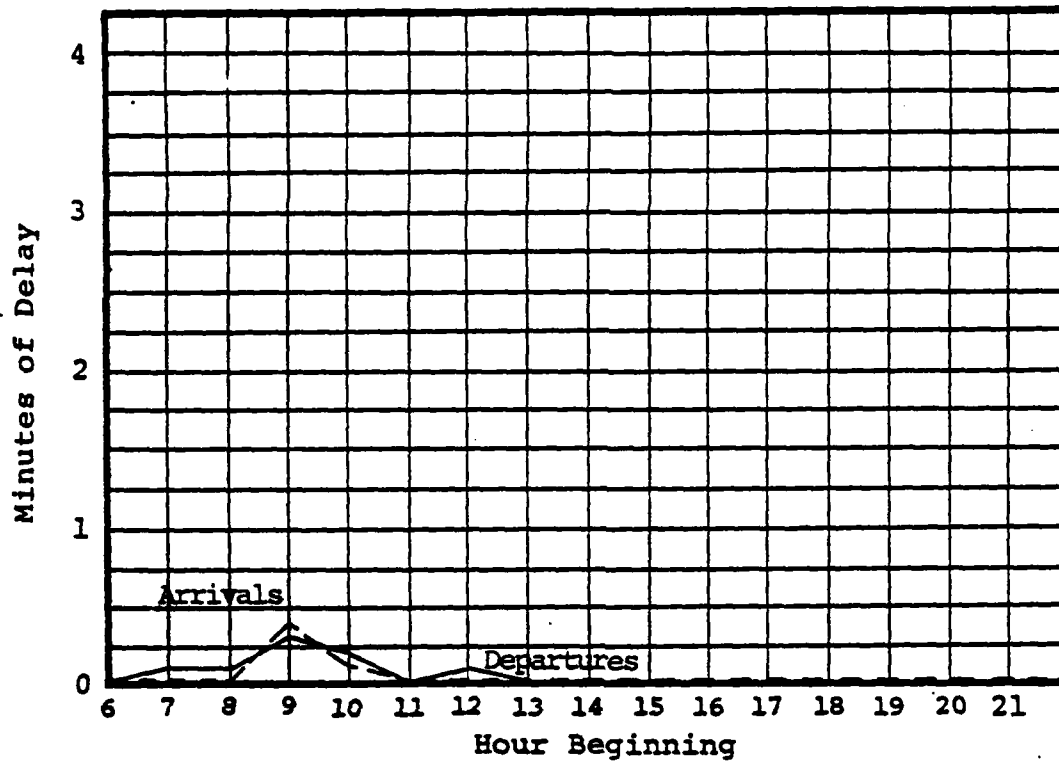
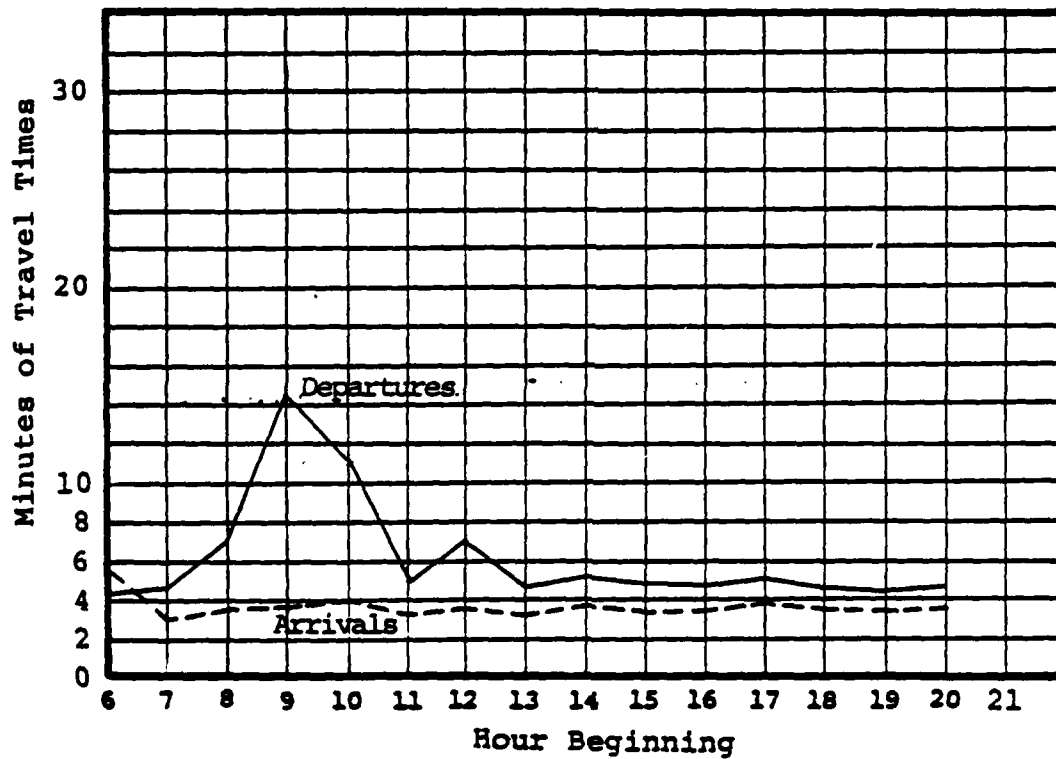


FIGURE 3D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 7

Objective:

To obtain 1977 baseline delay estimates for the following runway use in IFR1 weather:

<u>Arrival Runways</u>	<u>Departure Runways</u>
19L	10L, 10R

Related Comparison Experiments:

None directly in Stage I.

Results:

Figure 7A shows that total aircraft flows vary from 9 to 53 aircraft per hour over the 7 hour simulation run. The peak hour is from 1000 to 1100 hours and contains 25 arrival aircraft and 28 departure aircraft.

Figure 7B shows that average delays to aircraft using the runways are as high as 58.7 minutes per aircraft. Peak hour average delays are 47.4 minutes for arrival aircraft and 58.7 minutes for departure aircraft.

Figure 7C shows that the peak-period average delays to aircraft using the taxiways are 17.1 minutes for taxi-in operations and 9.3 minutes for taxi-out operations.

Figure 7D shows that average aircraft taxi travel times vary from 2.4 to 52.9 minutes. Peak-hour average taxi travel times are 22.2 minutes for arrival aircraft and 52.9 minutes for departure aircraft.

FIGURE 7A AVERAGE RUNWAY FLOW RATES

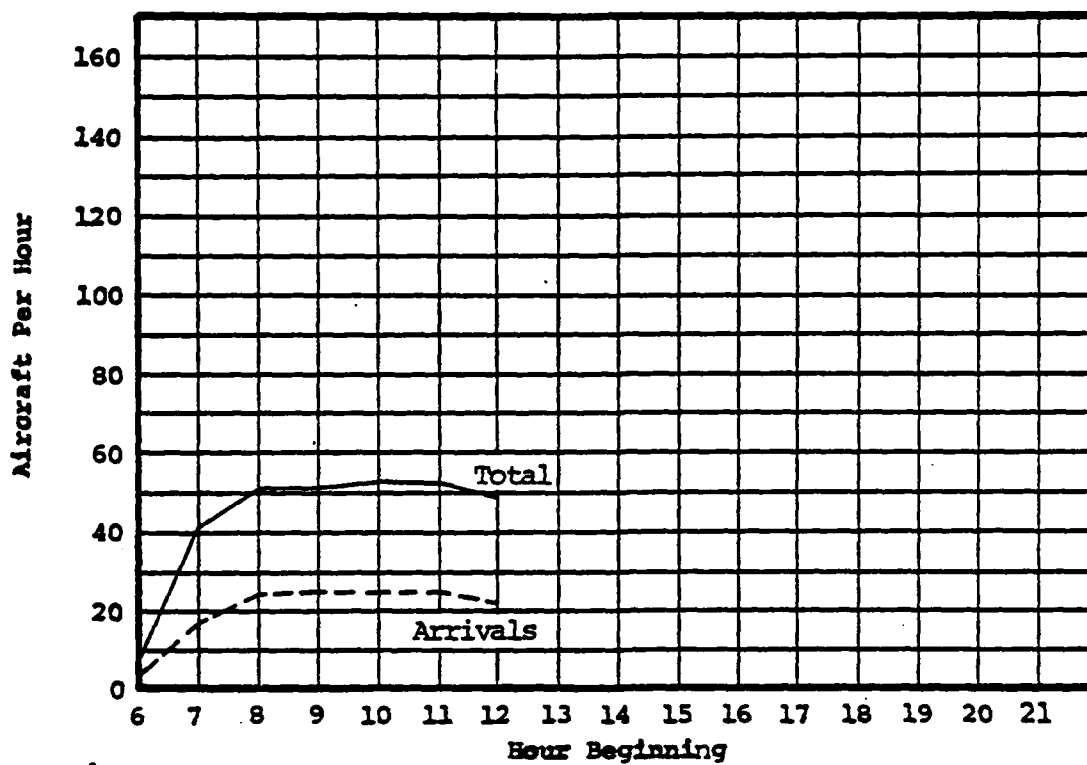


FIGURE 7B AVERAGE RUNWAY DELAYS

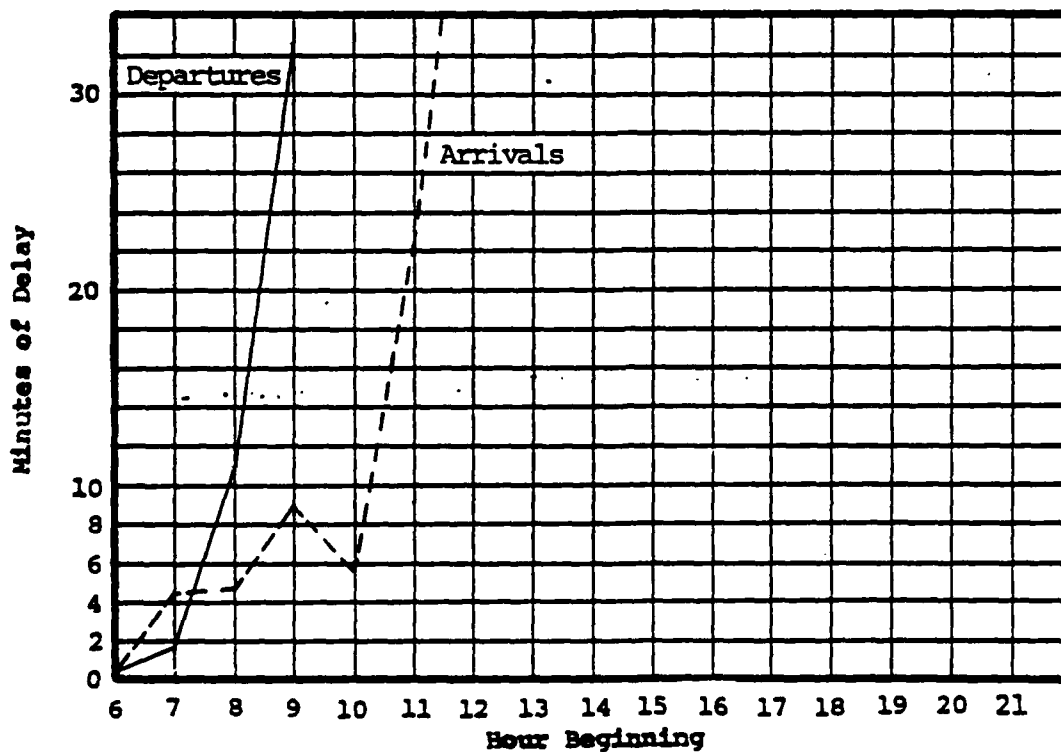


FIGURE 7C AVERAGE TAXIWAY DELAYS

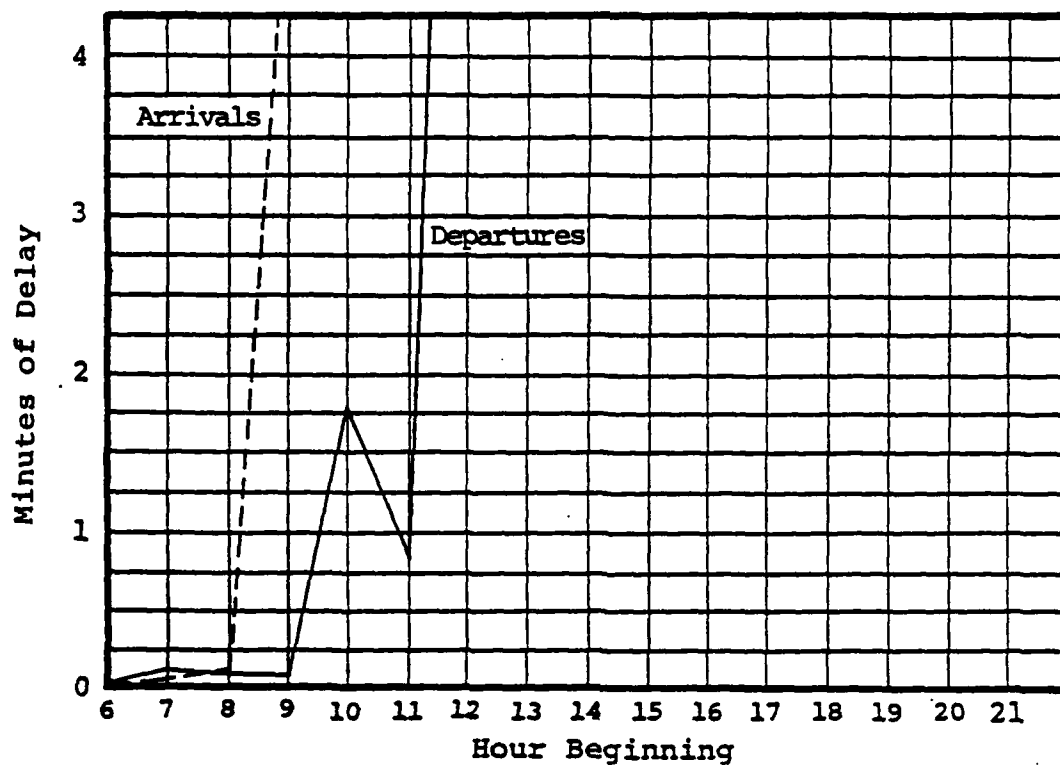
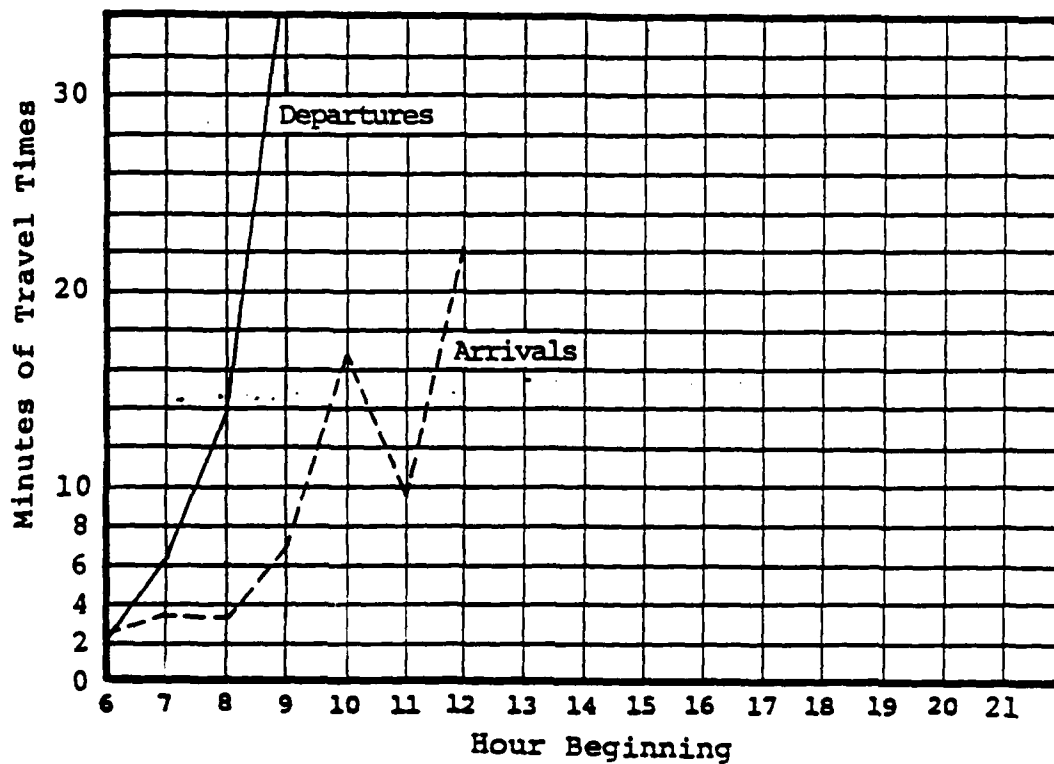


FIGURE 7D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 8

Objective:

To obtain 1977 baseline delay estimates for the following runway use in VFR2 weather:

Arrival Runways

19L, 19R

Departure Runways

19L, 19R

Related Comparison Experiments:

None directly in Stage I.

Results:

Figure 8A shows that total aircraft flows vary from 11 to 69 aircraft per hour over the 15 hour simulation run. The peak hour is from 1900 to 2000 hours and contains 36 arrival aircraft and 33 departure aircraft.

Figure 8B shows that average delays to aircraft using the runways are as high as 8.4 minutes per aircraft. Peak hour average delays are 4.2 minutes for arrival aircraft and 8.4 minutes for departure aircraft.

Figure 8C shows that the peak-period average delays to aircraft using the taxiways are 0.3 minutes for taxi-in operations and 0.7 minutes for taxi-out operations.

Figure 8D shows that average aircraft taxi travel times vary from 2.8 to 14.0 minutes. Peak-hour average taxi travel times are 3.7 minutes for arrival aircraft and 14.0 minutes for departure aircraft.

FIGURE 8A AVERAGE RUNWAY FLOW RATES

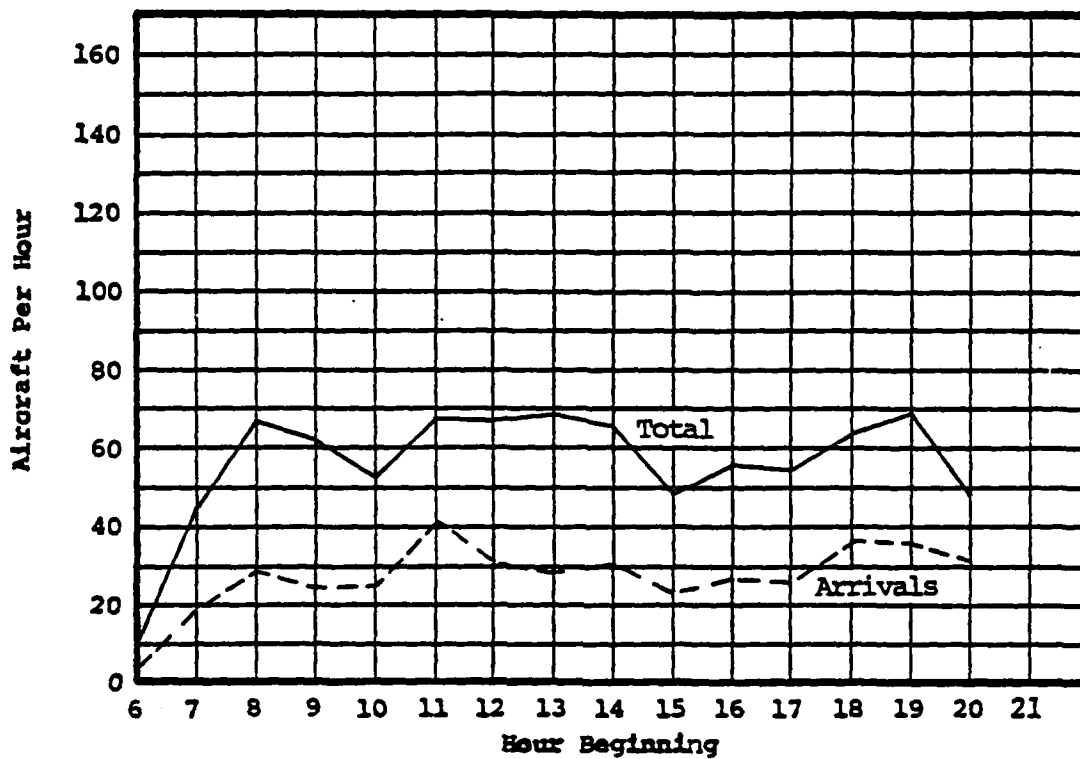


FIGURE 8B AVERAGE RUNWAY DELAYS

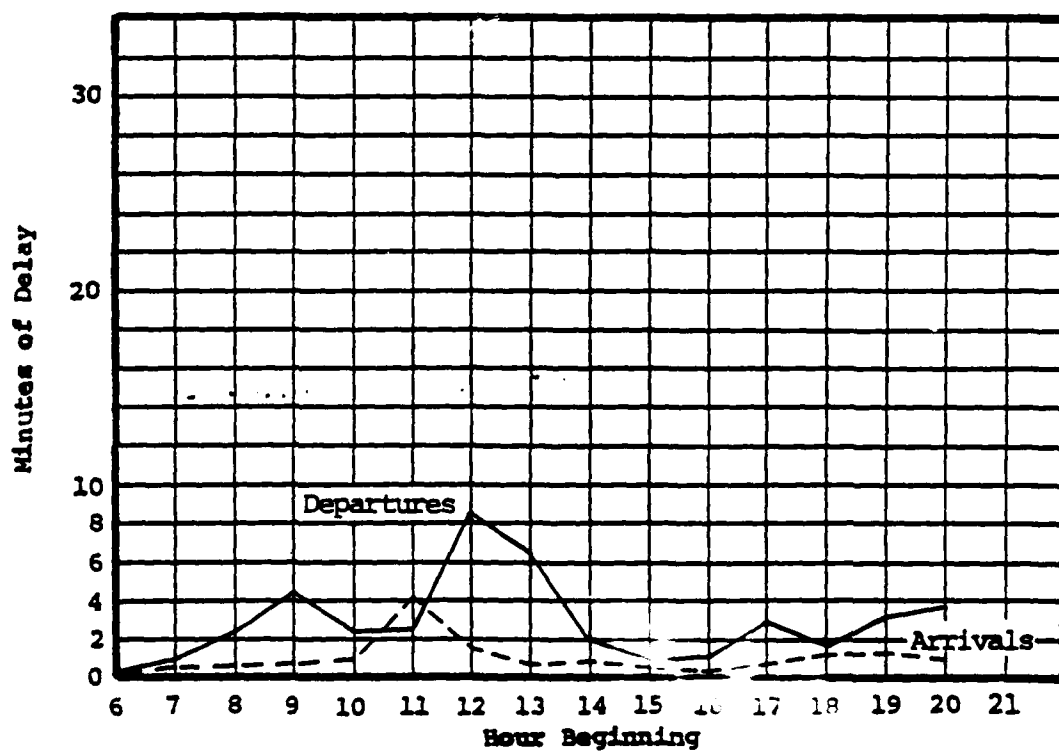


FIGURE 8C AVERAGE TAXIWAY DELAYS

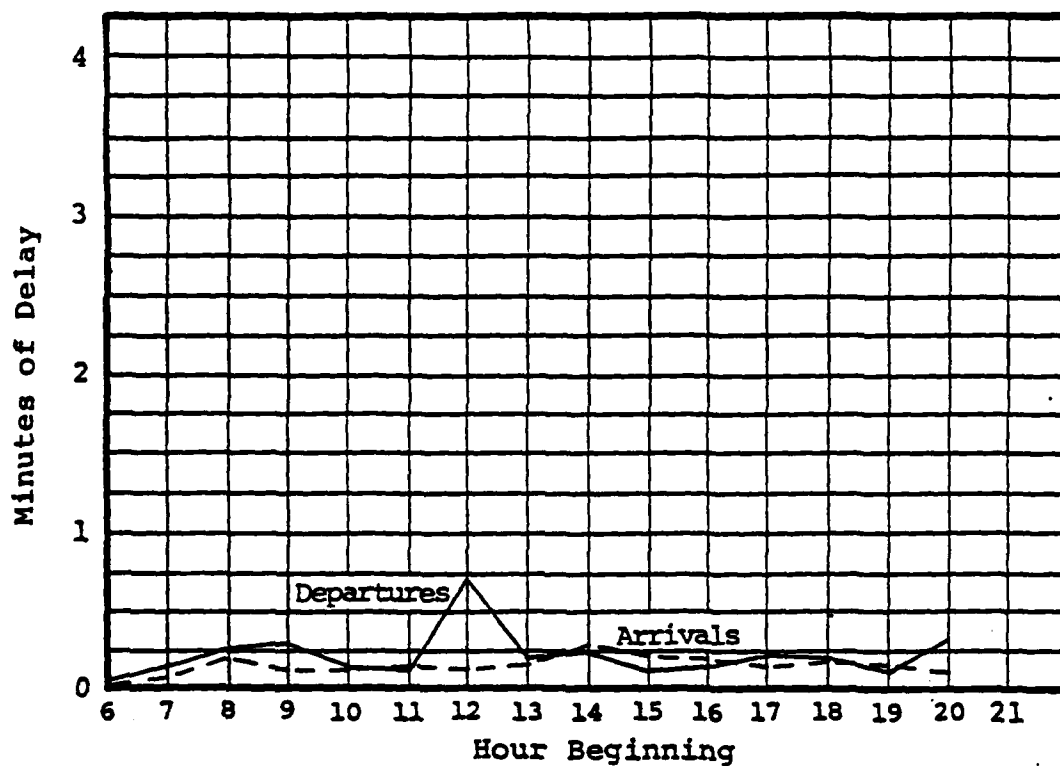
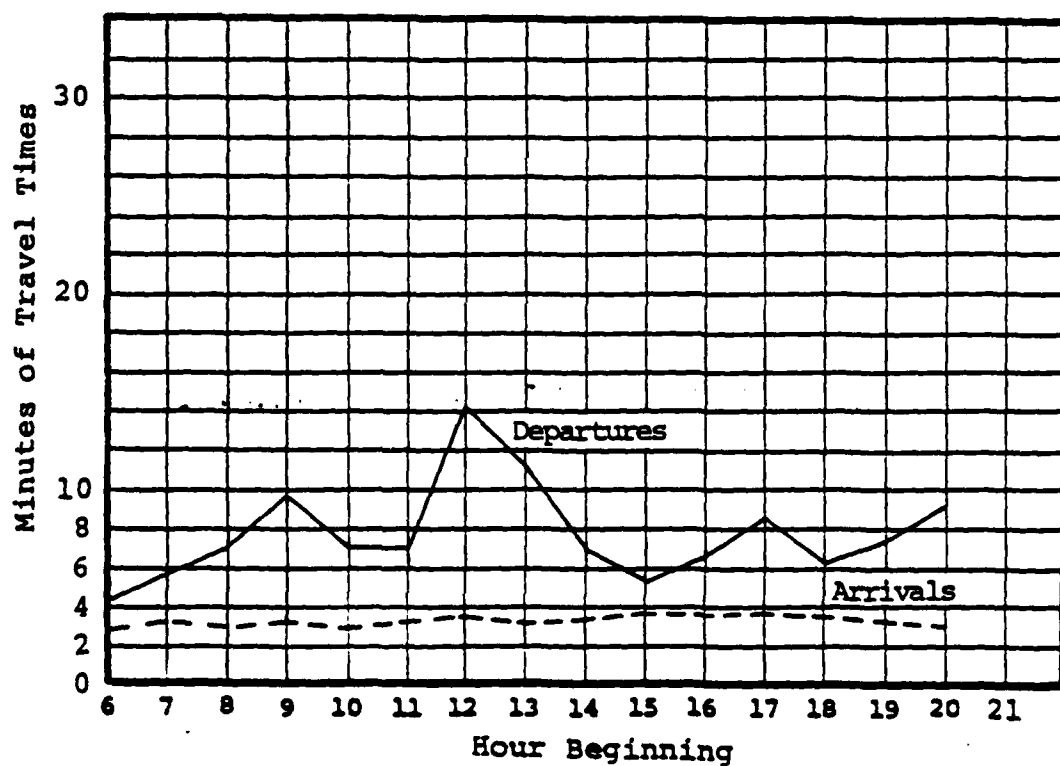


FIGURE 8D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 9

Objective:

To obtain 1977 baseline delay estimates for the following runway use in IFR2 weather:

<u>Arrival Runways</u>	<u>Departure Runways</u>
19L	19L, 19R

Related Comparison Experiments:

Experiment 10 estimates the impact of extending Taxiways L and V.

Results:

Figure 9A shows that total aircraft flows vary from 9 to 35 aircraft per hour over the 7 hour simulation run. The peak hour is from 0900 to 1000 hours and contains 19 arrival aircraft and 16 departure aircraft.

Figure 9B shows that average delays to aircraft using the runways are as high as 60+ minutes per aircraft. Peak hour average delays are 36.7 minutes for arrival aircraft and 60+ minutes for departure aircraft.

Figure 9C shows that the peak-period average delays to aircraft using the taxiways are 60+ minutes for taxi-in operations and 60+ minutes for taxi-out operations.

Figure 9D shows that average aircraft taxi travel times vary from 2.9 to 60+ minutes. Peak-hour average taxi travel times are 60+ minutes for arrival aircraft and 60+ minutes for departure aircraft.

FIGURE 9A AVERAGE RUNWAY FLOW RATES

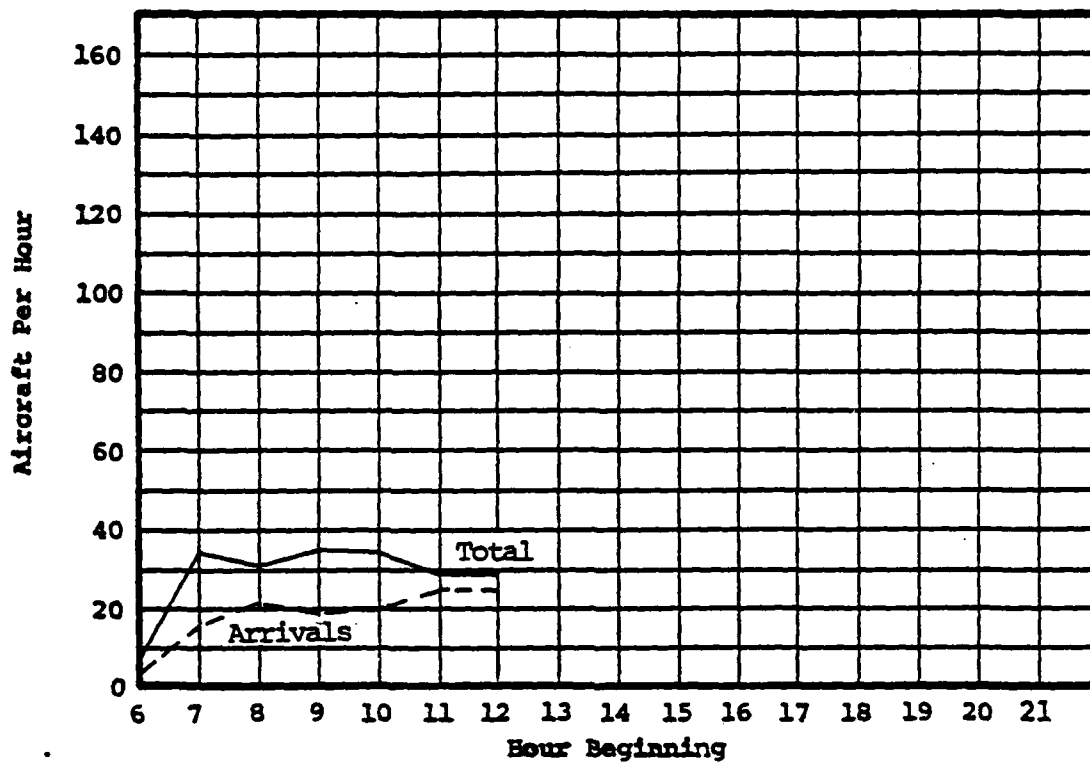


FIGURE 9B AVERAGE RUNWAY DELAYS

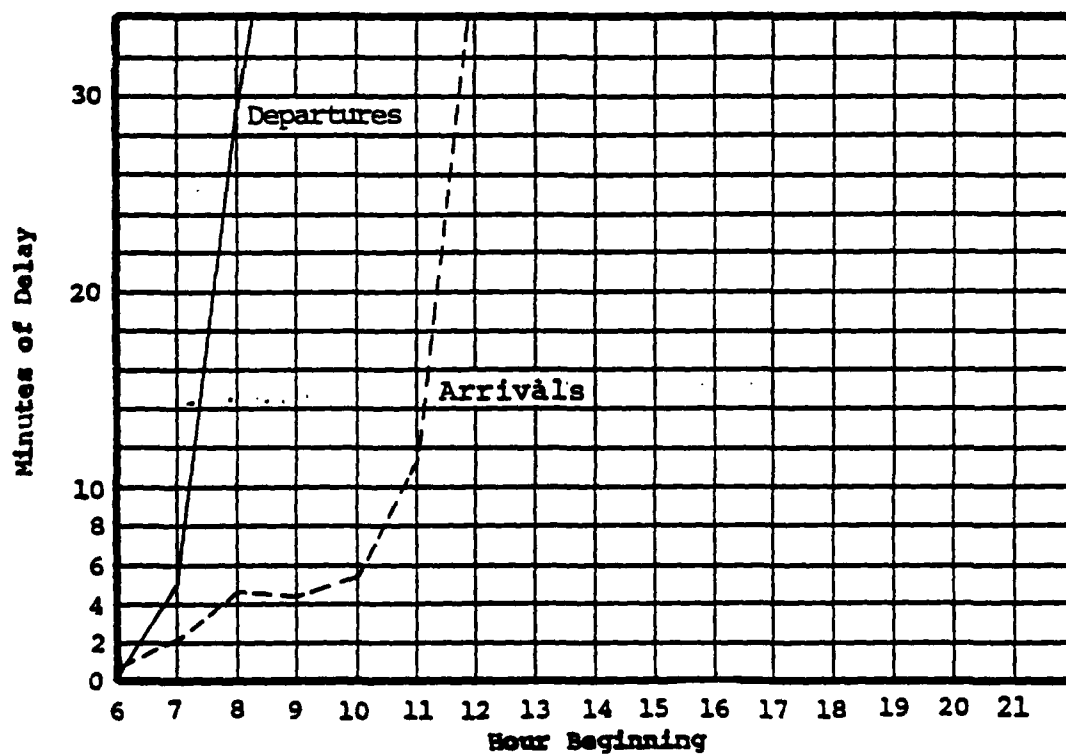


FIGURE 9C AVERAGE TAXIWAY DELAYS

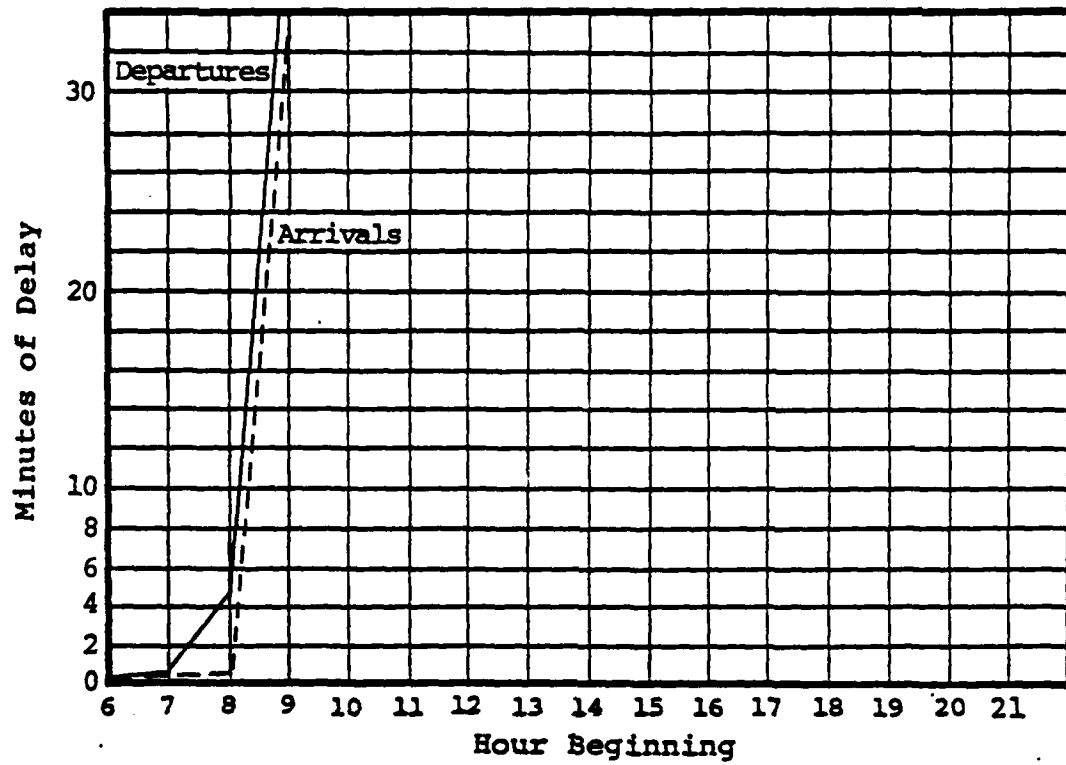
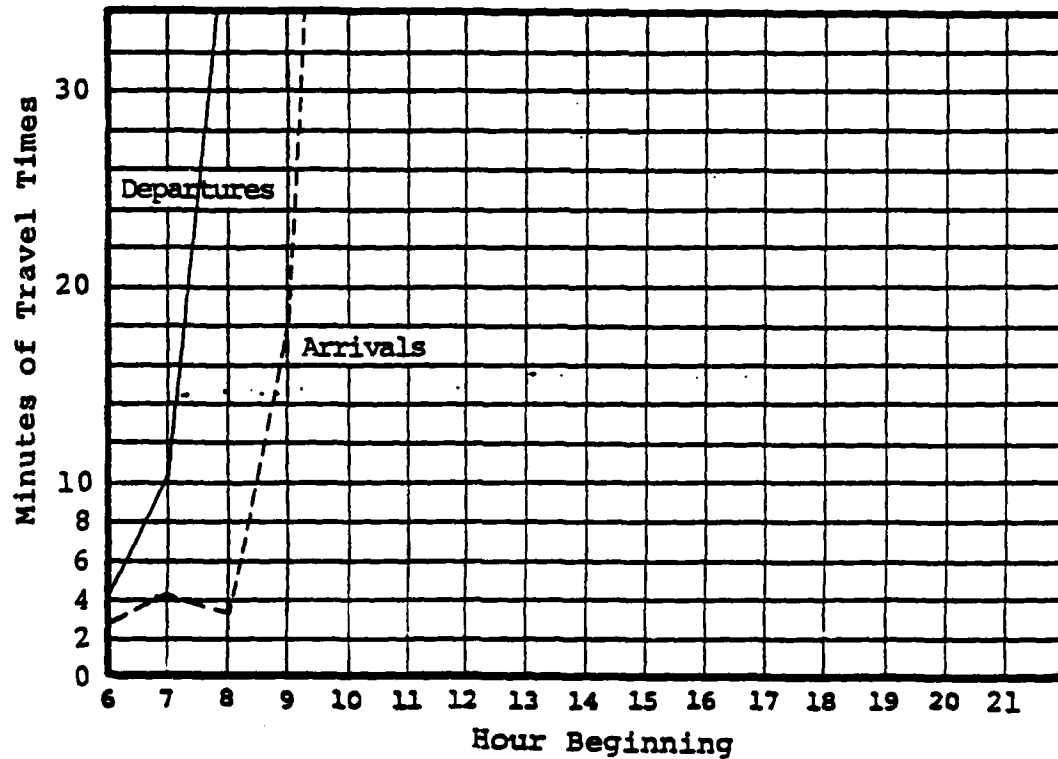


FIGURE 9D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 10

Objective:

To estimate the impact of the extensions of Taxiways L and V.

Related Comparison Experiments:

Experiment 9 is the 1977 baseline for comparison.

Results:

Figure 10A shows that total aircraft flows vary from 9 to 38 aircraft per hour over the 7 hour simulation run. The peak hour is from 1000 to 1100 hours and contains 20 arrival aircraft and 27 departure aircraft.

Figure 10B shows that average delays to aircraft using the runways are as high as 36.4 minutes per aircraft. Peak hour average delays are 36.4 minutes for arrival aircraft and 35.8 minutes for departure aircraft.

Figure 10C shows that the peak-period average delays to aircraft using the taxiways are 0.0 minutes for taxi-in operations and 0.2 minutes for taxi-out operations.

Figure 10D shows that average aircraft taxi travel times vary from 2.9 to 40.0 minutes. Peak-hour average taxi travel times are 4.0 minutes for arrival aircraft and 40.0 minutes for departure aircraft.

FIGURE 10A AVERAGE RUNWAY FLOW RATES

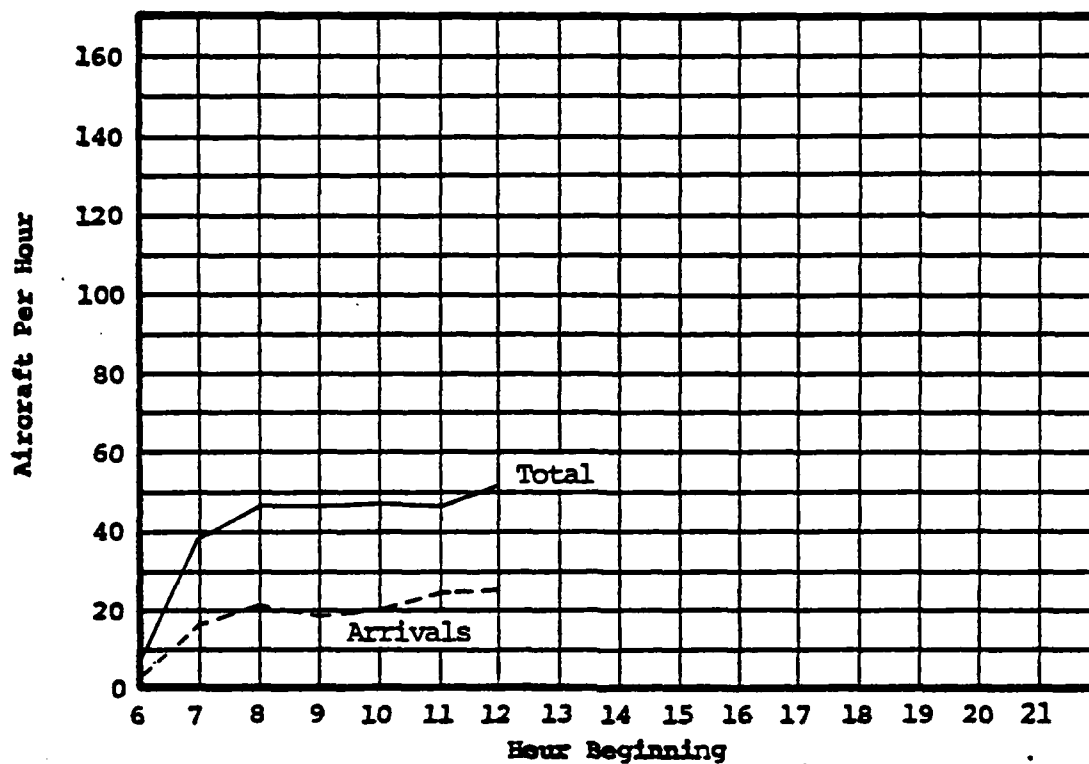


FIGURE 10B AVERAGE RUNWAY DELAYS

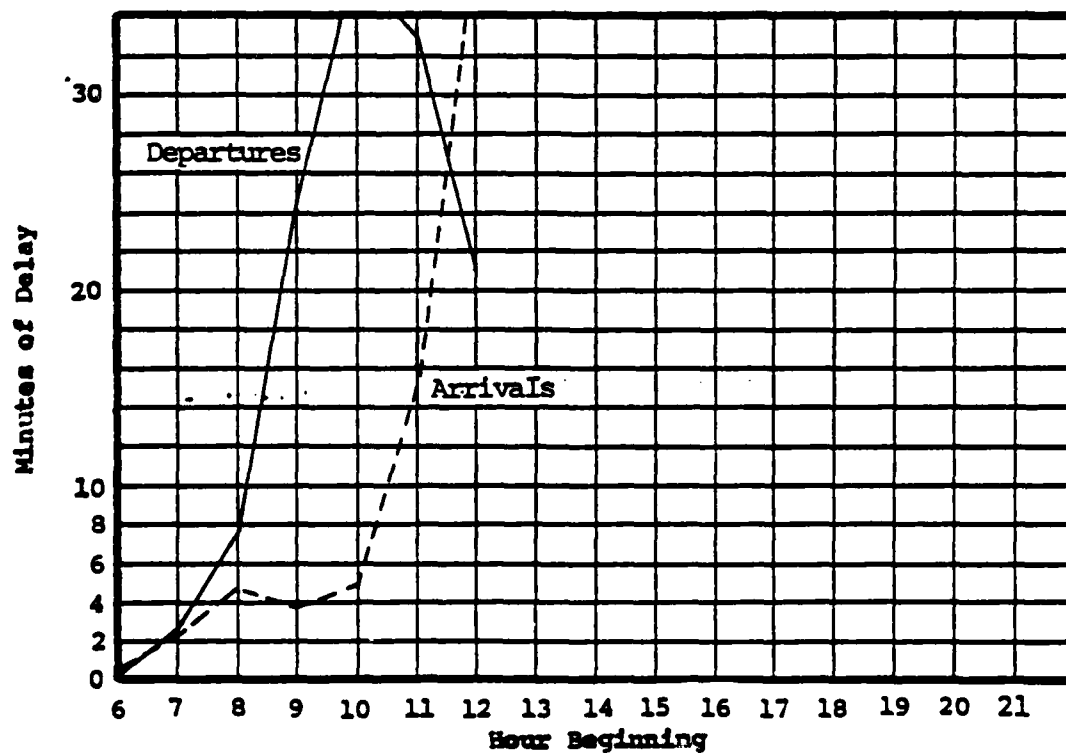


FIGURE 10C AVERAGE TAXIWAY DELAYS

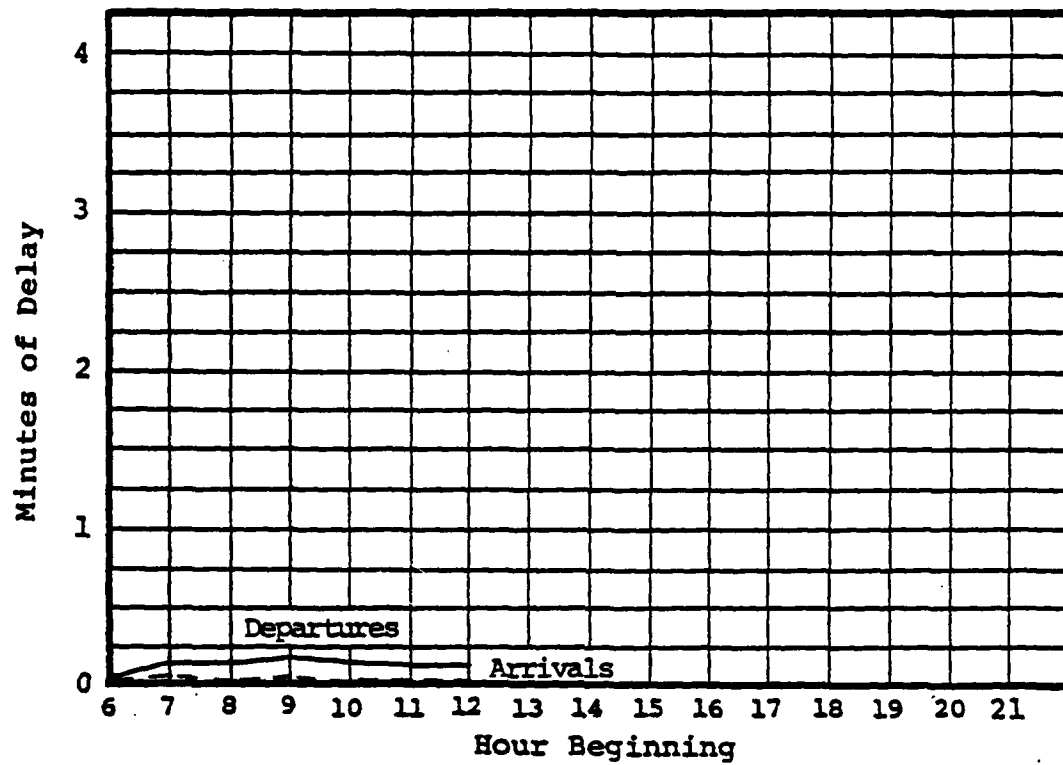
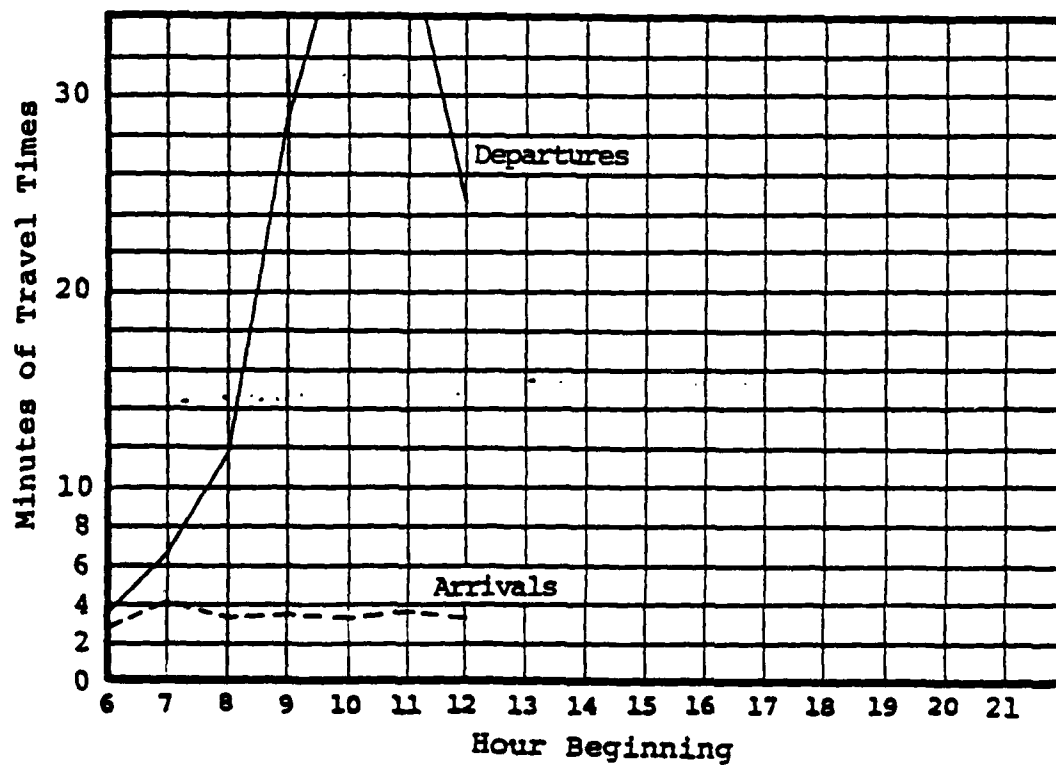


FIGURE 10D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 14

Objective:

To obtain 1977 baseline delay estimates for the following runway use in VFR1 weather:

Arrival Runways

28L, 28R

Departure Runways

1L, 28L

Related Comparison Experiments:

Experiment 13 estimates the impact of using Taxiway L as a utility runway.

Results:

Figure 14A shows that total aircraft flows vary from 11 to 70 aircraft per hour over the 15 hour simulation run. The peak hour is from 1200 to 1300 hours and contains 32 arrival aircraft and 38 departure aircraft.

Figure 14B shows that average delays to aircraft using the runways are as high as 4.2 minutes per aircraft. Peak hour average delays are 1.0 minutes for arrival aircraft and 4.2 minutes for departure aircraft.

Figure 14C shows that the peak-period average delays to aircraft using the taxiways are 0.5 minutes for taxi-in operations and 0.1 minutes for taxi-out operations.

Figure 14D shows that average aircraft taxi travel times vary from 2.4 to 8.2 minutes. Peak-hour average taxi travel times are 3.7 minutes for arrival aircraft and 8.2 minutes for departure aircraft.

FIGURE 14A AVERAGE RUNWAY FLOW RATES

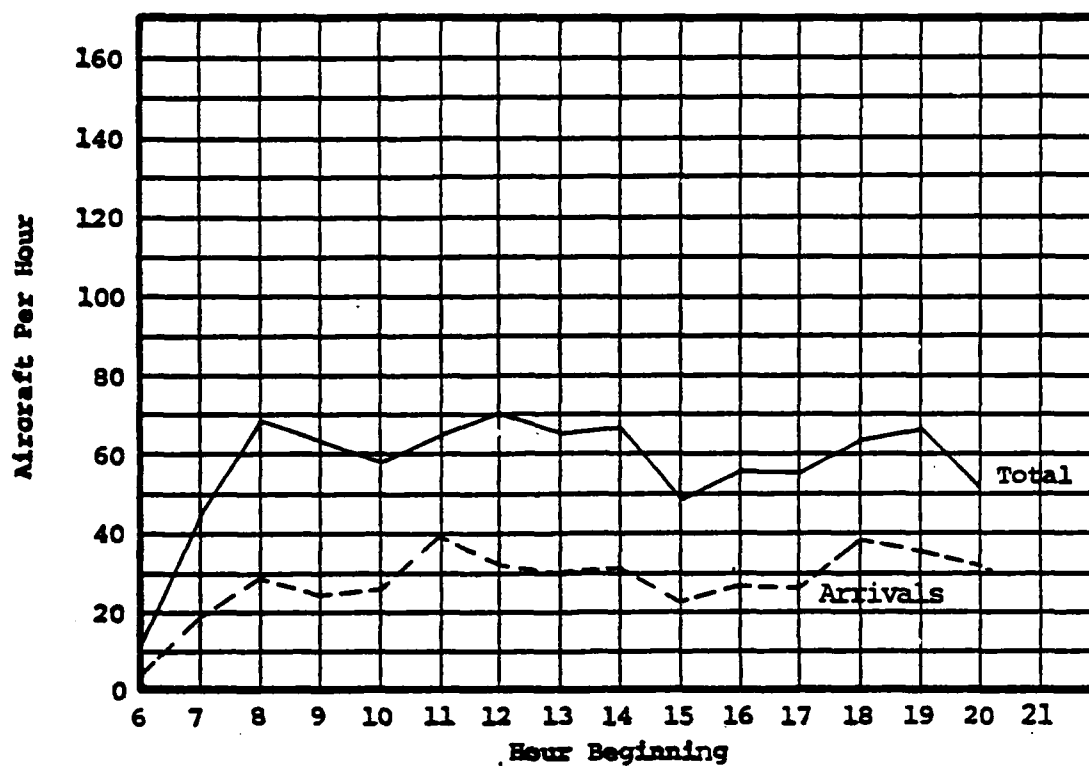


FIGURE 14B AVERAGE RUNWAY DELAYS

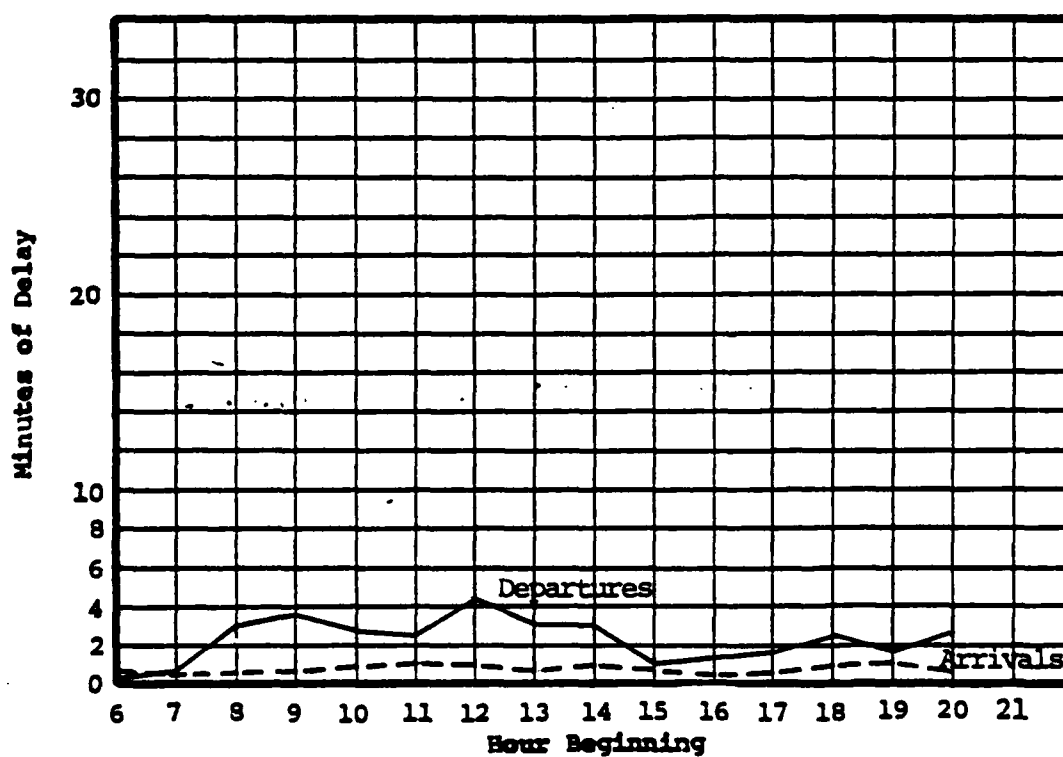


FIGURE 14C AVERAGE TAXIWAY DELAYS

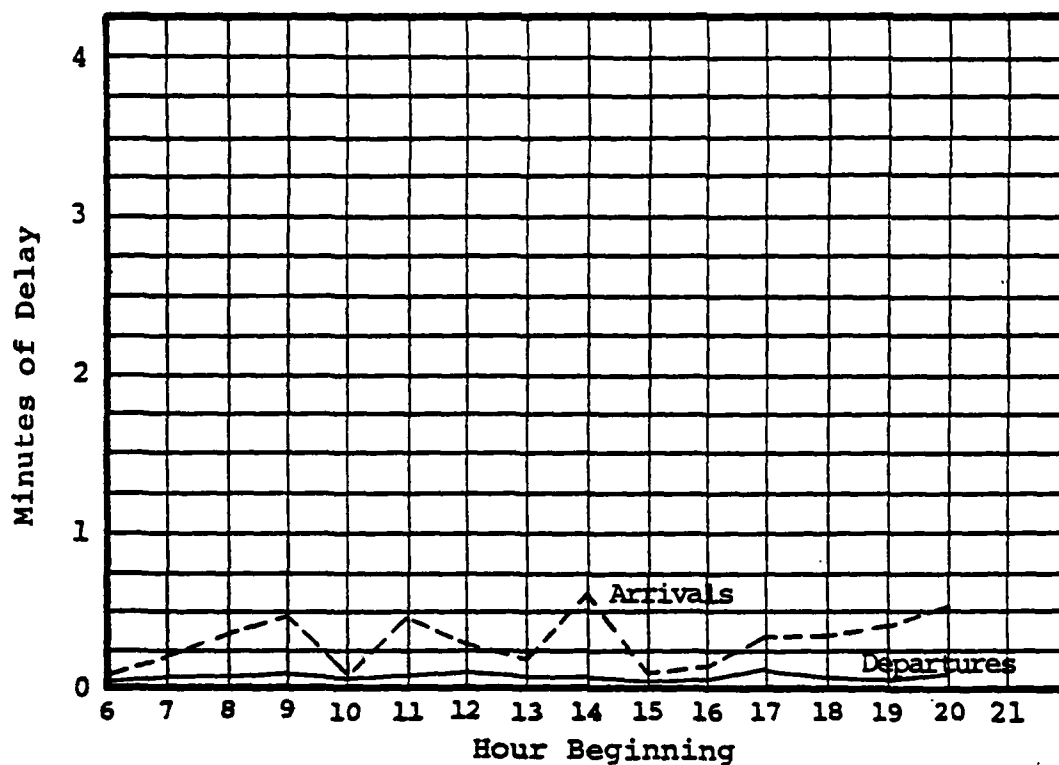
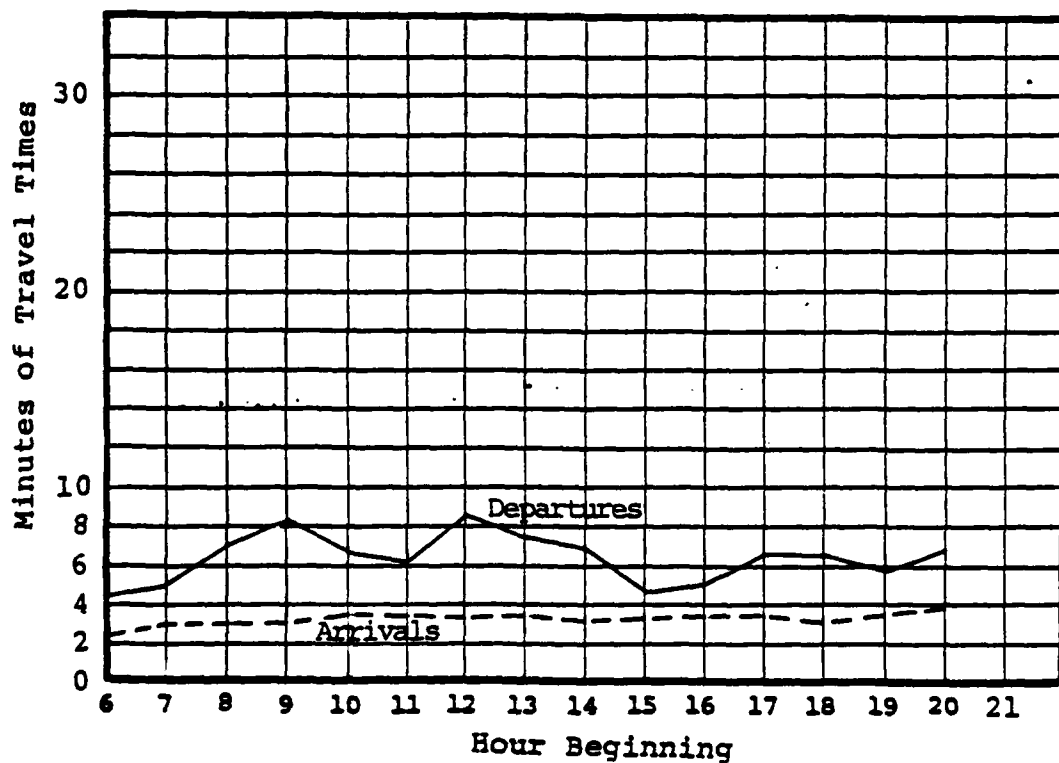


FIGURE 14D AVERAGE TAXIWAY TRAVEL TIMES



Attachment B

RESULTS OF STAGE 2 AIRFIELD
SIMULATION MODEL EXPERIMENTS

San Francisco International Airport
Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

March 1979

Table B-1

STAGE 2 ASM EXPERIMENTS
San Francisco International Airport
Airport Improvement Task Force Delay Studies

Experiment Number	Page Number	Model	Arrival Runways	Departure Runways	Weather	Demand	ATC Scenario	Near-Term Improvements
19	25	ASM	28L, 28R, 1L	1L, 1R, 28R	VFR 1	1982	1982	All ^a
20	28	ASM	28R	1L, 1R, 28L	IFR 1	1982	1982	All
20A	31	ASM	28R	1L, 1R, 28L	IFR 1	1982	1982	GA Diversion
21	34	ASM	28R	28L	IFR 1	1982	1982	All
22	37	ASM	19L, 19R	10L, 10R, 19R	VFR 1	1982	1982	All
23	40	ASM	19L	19L, 19R	IFR 2	1982	1982	All

a. All near-term improvements as follows: Extend taxiways L, V, K; extend 1L/19R, VASI on 19R; 10L/10R simultaneous departures; utility runways on taxiways C, L.

STAGE 1 and 2 AIRFIELD SIMULATION MODEL EXPERIMENTS

DELAY SUMMARY

Experiment Number	Page Number	Weather	Demand	ATC Scenario	Experiment Description	Runway Delay (Minutes)			
						Arrivals		Departures	
						Max. Average	Average Daily ^a	Max. Average	Average Daily ^a
1	25	VFR1	1977	Today	Baseline	0.9	0.5	2.7	1.6
19			1982	1982	Baseline	1.6	0.7	5.4	2.5
2	28	VFR2	1977	Today	Baseline	4.3	1.2	3.3	1.8
3		IFR1	1977	Today	Baseline	60+	53.5	10.7	3.2
20			1982	1982	Baseline	60+	60+	27.6	15.9
20A			31		GA Diversion	51.7	24.4	34.1	19.3
4	34	VFR1	1977	Today	Baseline	1.2	0.7	5.4	2.3
5		IFR1	1977	Today	Baseline	60+	55.3	4.4	1.3
21			1982	1982	Baseline	60+	60+	14.6	3.5
6	37	VFR1	1977	Today	Baseline	2.5	0.9	5.9	2.9
11					Extend 1L/19R, VASI on 19R	1.2	0.6	6.3	3.1
12					Extend Taxiway K, 10L/10R Departs	2.6	0.9	2.5	1.6
22			1982	1982	Baseline	1.9	0.8	5.4	2.6
7	7	IFR1	1977	Today	Baseline	47.4	15.2 ^b	58.7	33.2 ^b
8	10	VFR2	1977	Today	Baseline	4.2	1.1	8.4	3.2
9	13	IFR2	1977	Today	Baseline	36.8	12.4 ^b	60+	48.0 ^b
10	16				Extend Taxiways L and V	36.4	12.7 ^b	38.5	20.4 ^b
23	40		1982	1982	Baseline	25.8	8.0	60+	14.6
14	19	VFR1	1977	Today	Baseline	1.0	0.7	4.2	2.4
13					Utility Runway on Taxiway L	0.7	0.3	3.6	1.7
15		VFR1	1977	Today	Baseline	16.9	7.7	5.8	3.1
18					Utility Runway on Taxiway C	5.0	1.8	3.9	2.1

a. 15-hour daily average (0600-2100) except as noted.

b. 7-hour daily average (0600-1300).

Experiment No. 19

Objective:

To obtain 1982 baseline delay estimates for the following runway use in VFR1 weather:

Arrival Runways

28L, 28R, 1L

Departure Runways

1L, 1R, 28L

Related Comparison Experiments:

Experiment No. 1 is the baseline case for 1977.

Results:

Figure 19A shows that total aircraft flows vary from 21 to 88 aircraft per hour over the 15 hour simulation run. The peak hour is from 1200 to 1300 hours and contains 39 arrival aircraft and 49 departure aircraft.

Figure 19B shows that average delays to aircraft using the runways are as high as 5.4 minutes per aircraft. Peak hour average delays are 1.6 minutes for arrival aircraft and 5.4 minutes for departure aircraft.

Figure 19C shows that the peak-period average delays to aircraft using the taxiways are 0.6 minutes for taxi-in operations and 0.2 minutes for taxi-out operations.

Figure 19D shows that average aircraft taxi travel times vary from 2.8 to 10.3 minutes. Peak-hour average taxi travel times are 3.6 minutes for arrival aircraft and 10.3 minutes for departure aircraft.

FIGURE 19A AVERAGE RUNWAY FLOW RATES

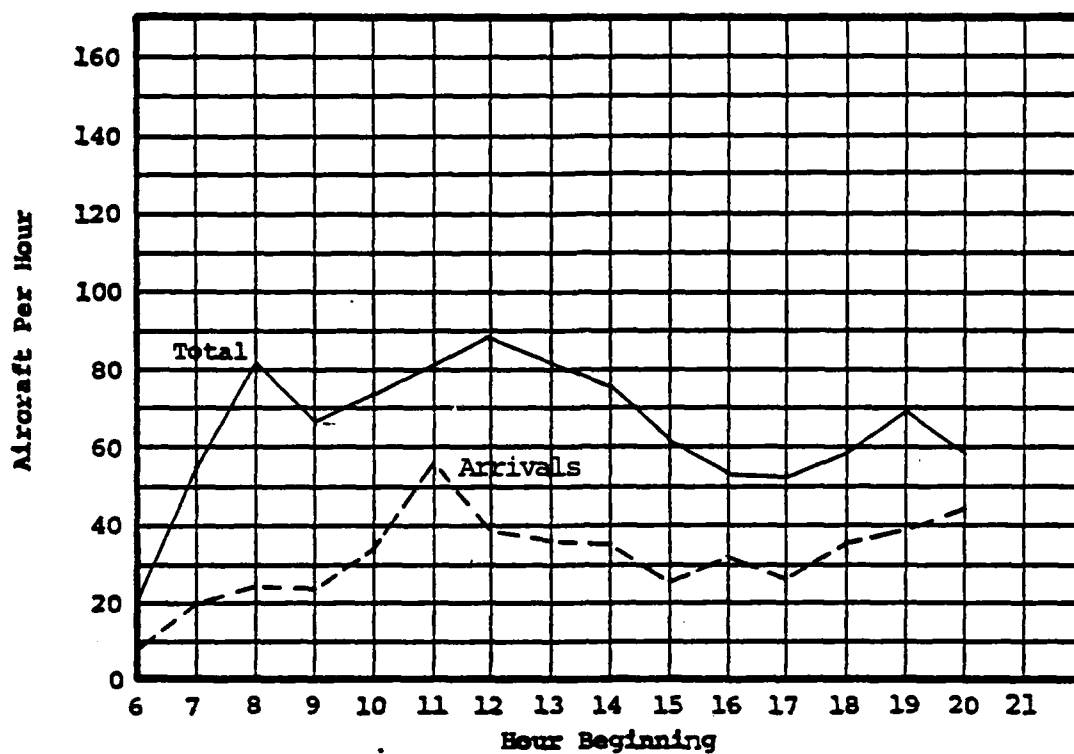


FIGURE 19B AVERAGE RUNWAY DELAYS

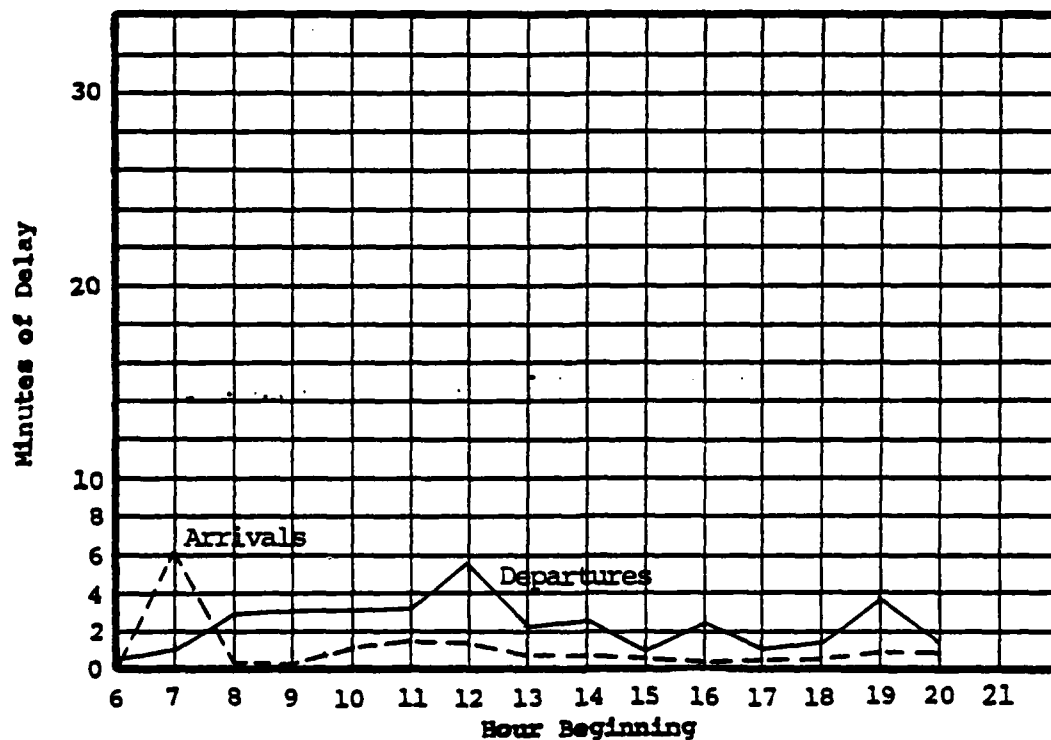


FIGURE 19C AVERAGE TAXIWAY DELAYS

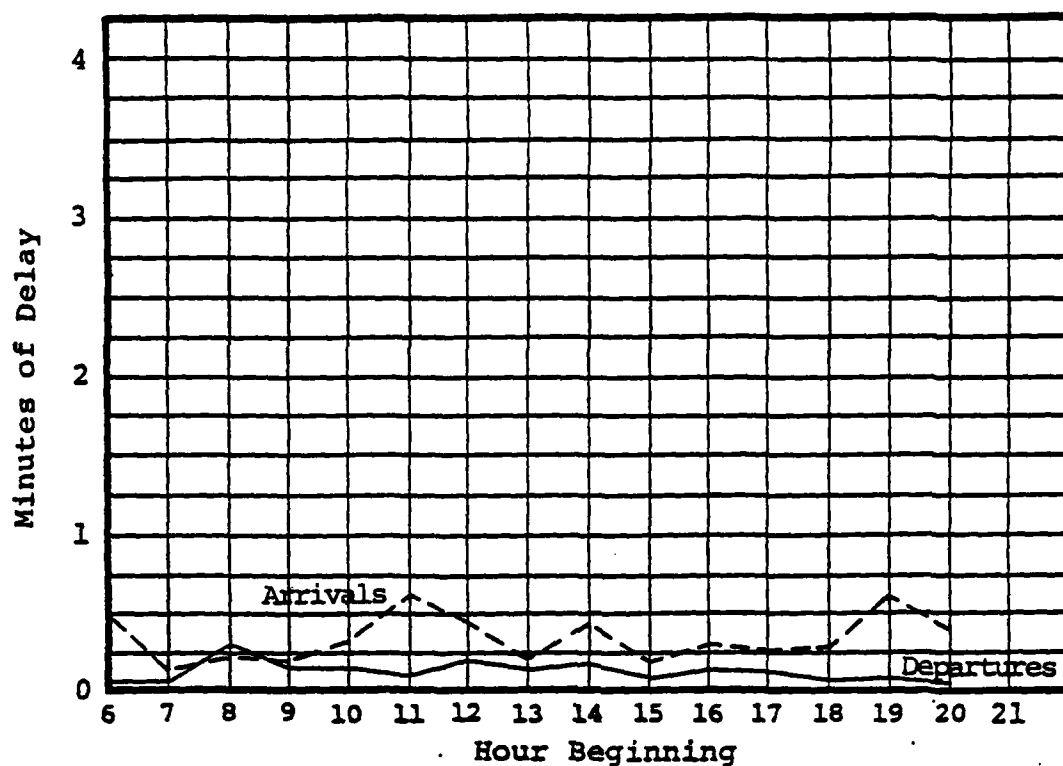
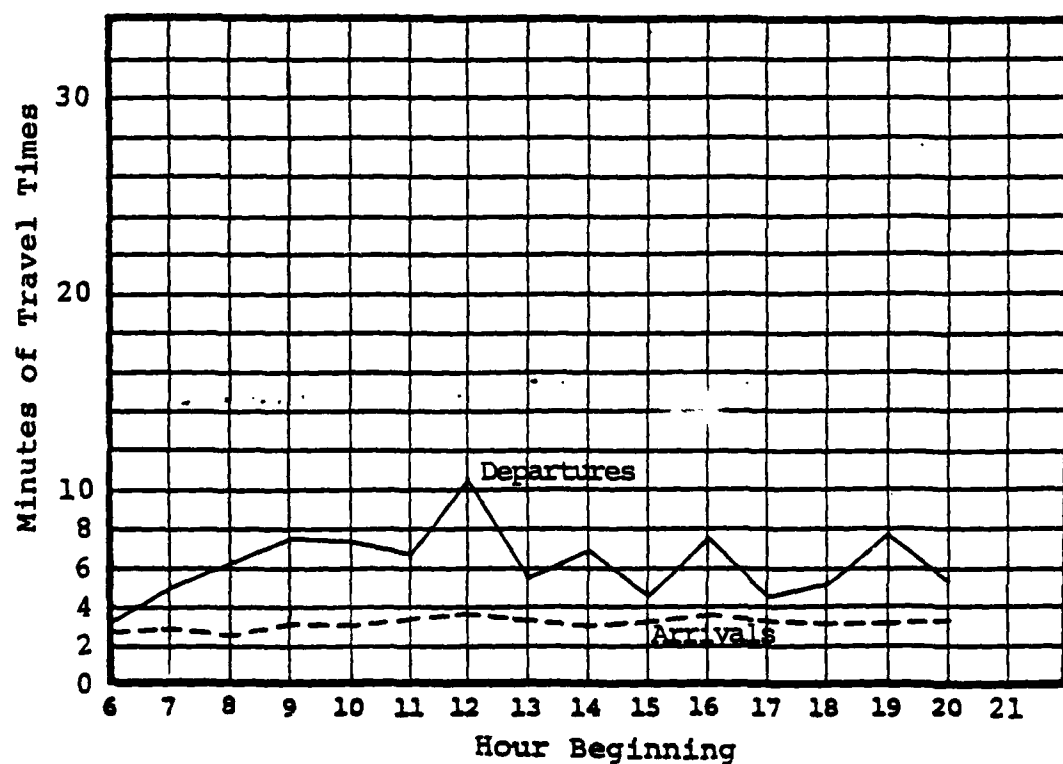


FIGURE 19D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 20

Objective:

To obtain 1982 baseline delay estimates for the following runway use in IFR1 weather:

Arrival Runways

28R

Departure Runways

1L, 1R, 28L

Related Comparison Experiments:

Experiment 3 is the baseline case for 1977. Experiment 20A evaluates the effects of a general aviation diversion.

Results:

Figure 20A shows that total aircraft flows vary from 21 to 67 aircraft per hour over the 15-hour simulation run. The peak hour is from 0900 to 1000 hours and contains 28 arrival aircraft and 39 departure aircraft.

Figure 20B shows that average delays to aircraft using the runways are as high as 60+ minutes per aircraft. Peak-hour average delays are 60+ minutes for arrival aircraft and 27.6 minutes for departure aircraft.

Figure 20C shows that the peak-period average delays to aircraft using the taxiways are 22.4 minutes for taxi-in operations and 5.3 minutes for taxi-out operations.

Figure 20D shows that average aircraft taxi travel times vary from 2.9 to 39.4 minutes. Peak-hour average taxi travel times are 22.1 minutes for arrival aircraft and 39.4 minutes for departure aircraft.

FIGURE 20A AVERAGE RUNWAY FLOW RATES

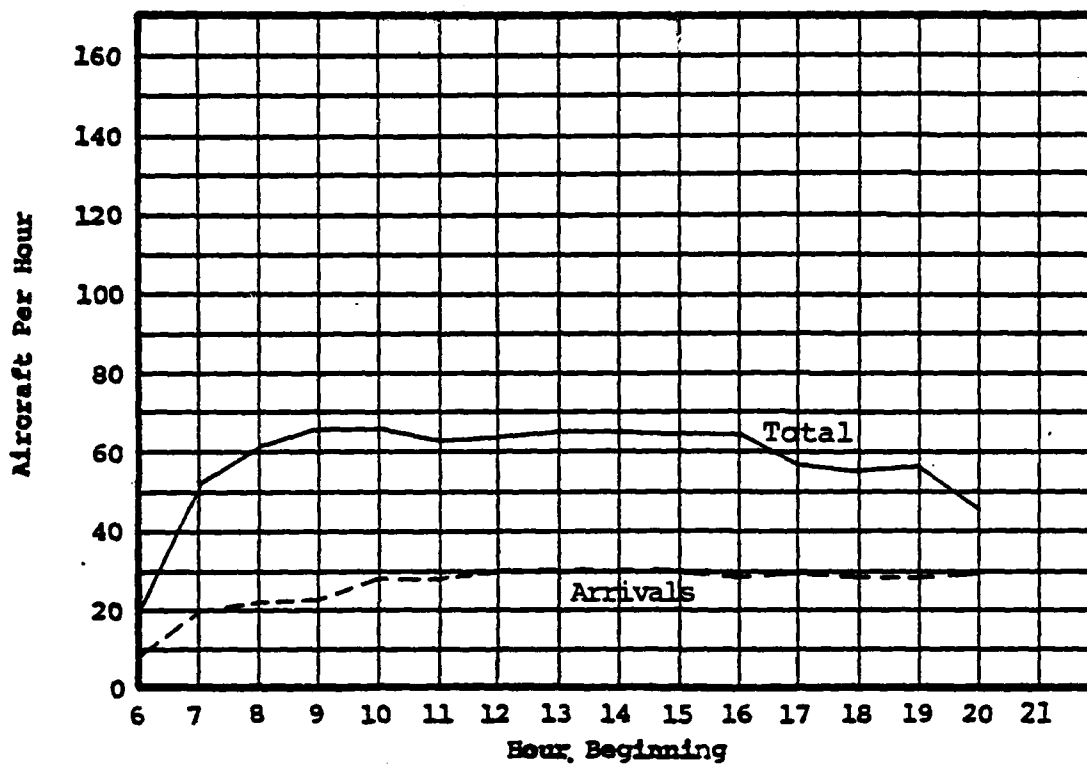


FIGURE 20B AVERAGE RUNWAY DELAYS

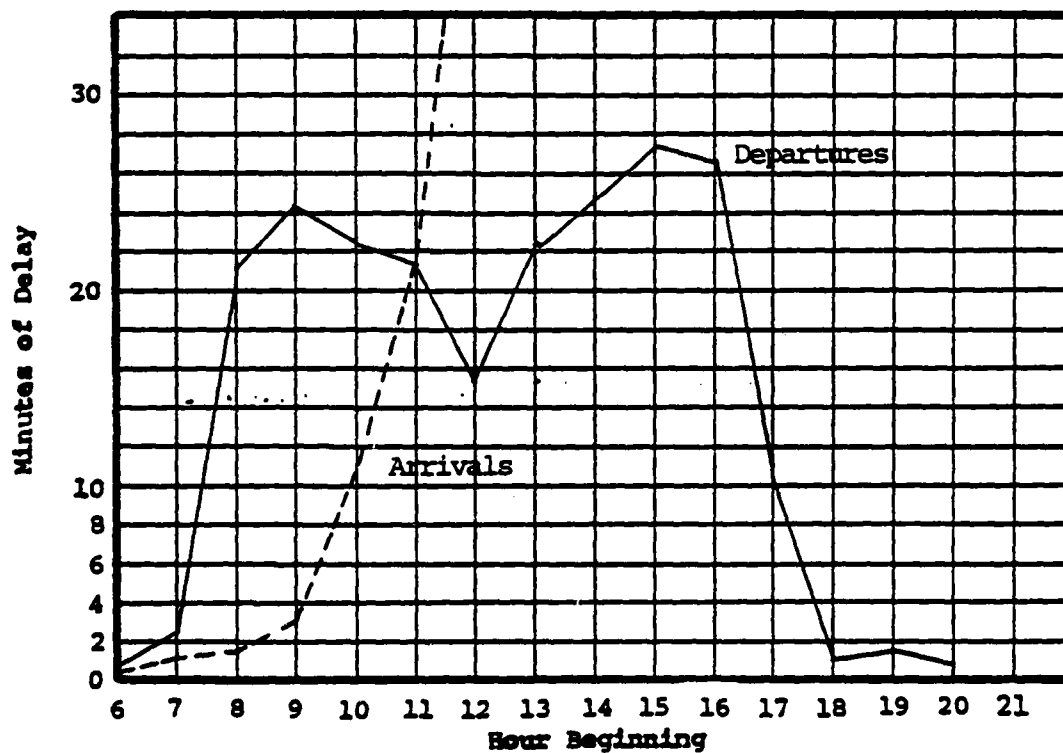


FIGURE 20C AVERAGE TAXIWAY DELAYS

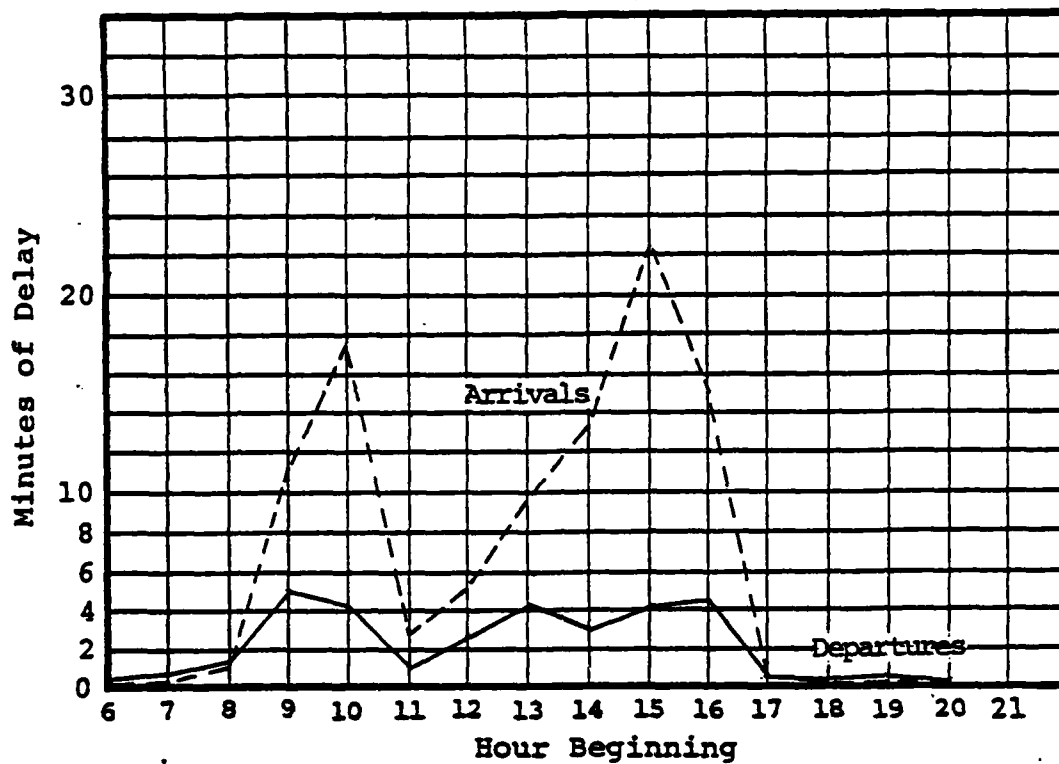
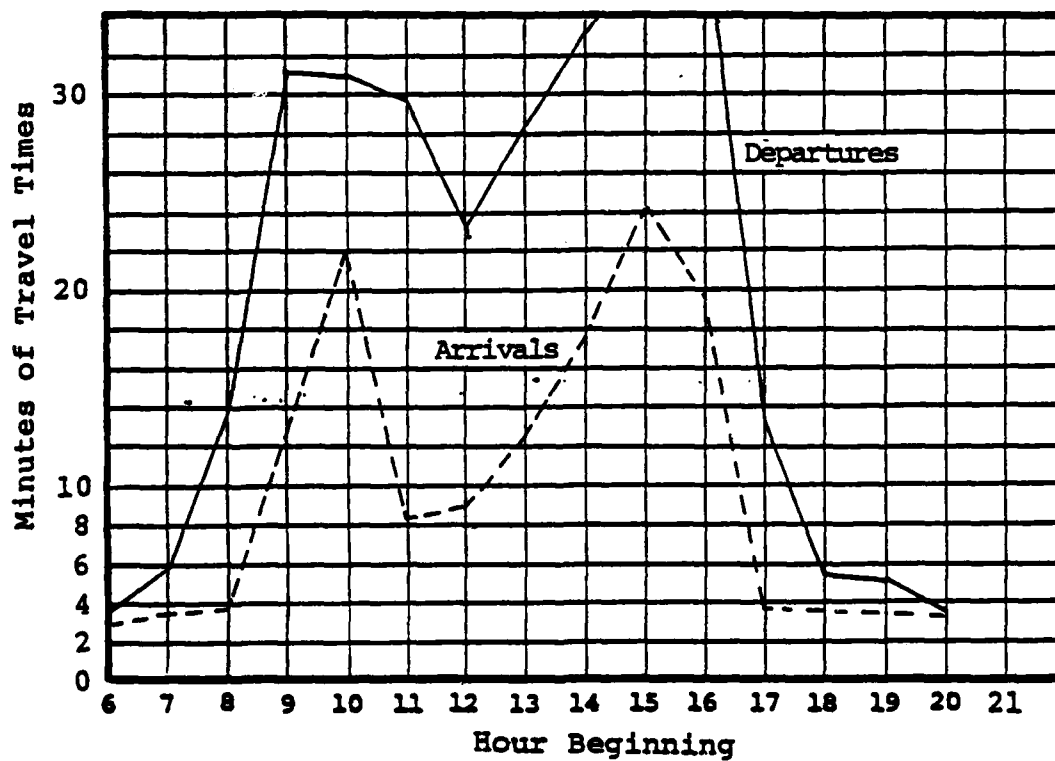


FIGURE 20D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 20A

Objective:

To estimate the effects of diverting all general aviation activity to other airports:

Arrival Runways

28R

Departure Runways

1L, 1R, 28L

Related Comparison Experiments:

Experiment 20 is the 1982 baseline for comparison.

Results:

Figure 20AA shows that total aircraft flows vary from 15 to 62 aircraft per hour over the 15-hour simulation run. The peak hour is from 1100 to 1200 hours and contains 30 arrival aircraft and 32 departure aircraft.

Figure 20AB shows that average delays to aircraft using the runways are as high as 51.7 minutes per aircraft. Peak-hour average delays are 51.7 minutes for arrival aircraft and 37.9 minutes for departure aircraft.

Figure 20AC shows that the peak-period average delays to aircraft using the taxiways are 23.9 minutes for taxi-in operations and 9.9 minutes for taxi-out operations.

Figure 20AD shows that average aircraft taxi travel times vary from 3.1 to 45.1 minutes. Peak-hour average taxi travel times are 28.9 minutes for arrival aircraft and 45.1 minutes for departure aircraft.

FIGURE (20A)A AVERAGE RUNWAY FLOW RATES

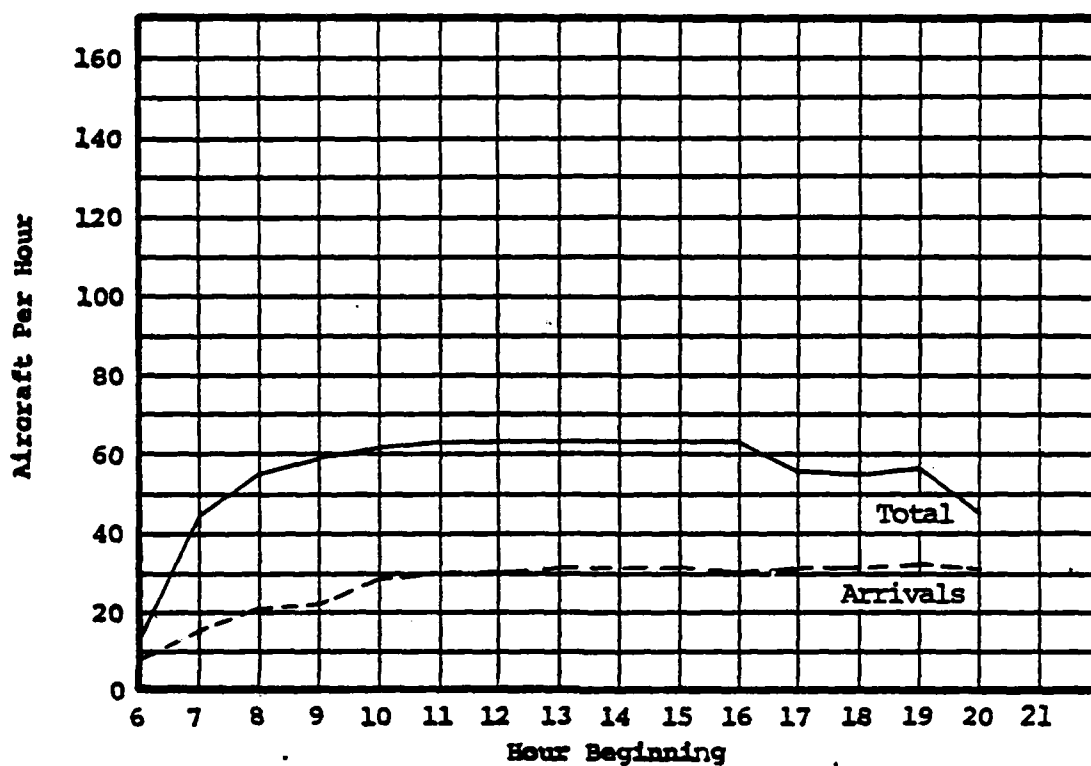


FIGURE (20A)B AVERAGE RUNWAY DELAYS

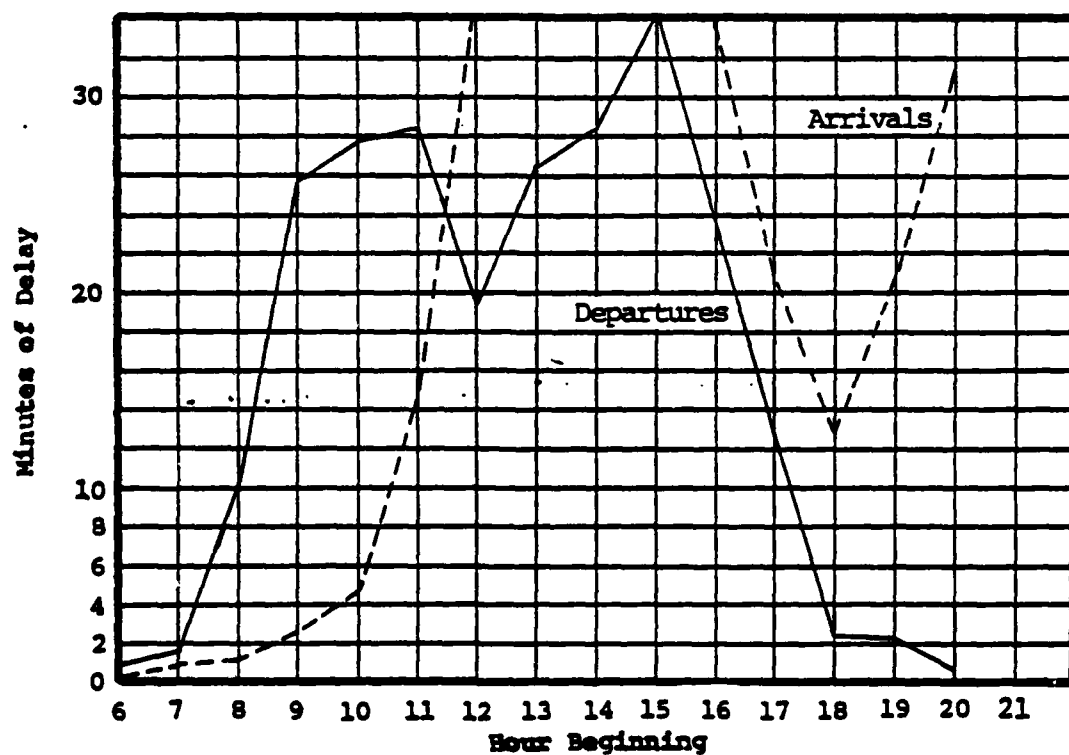
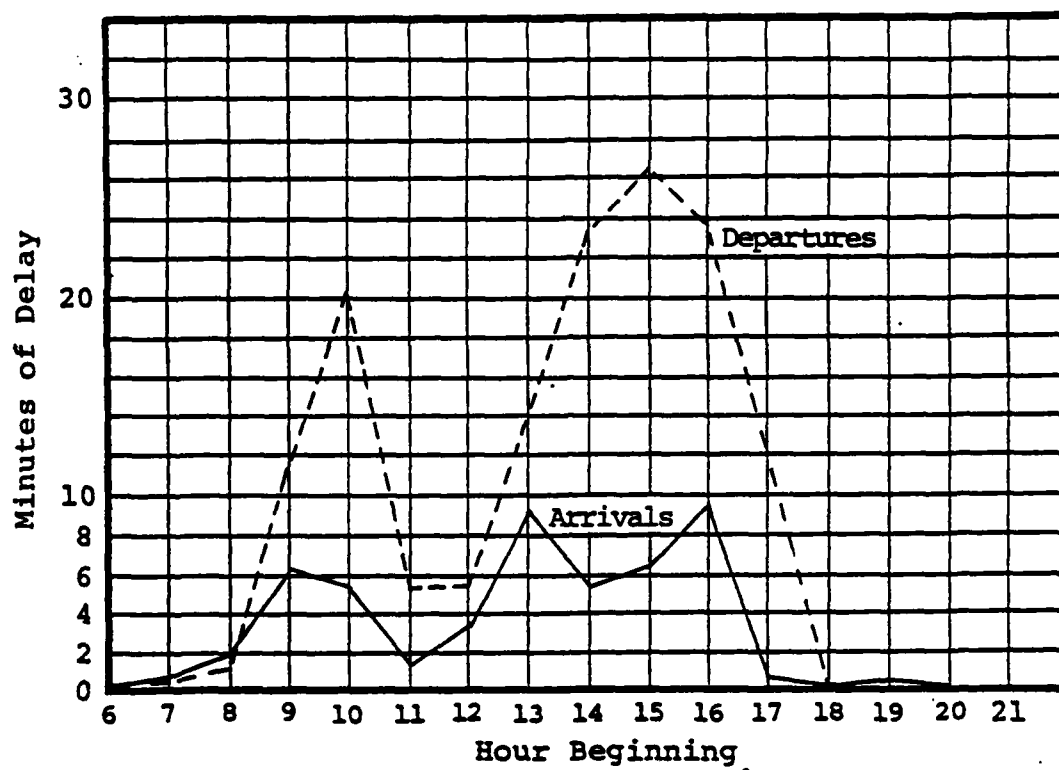
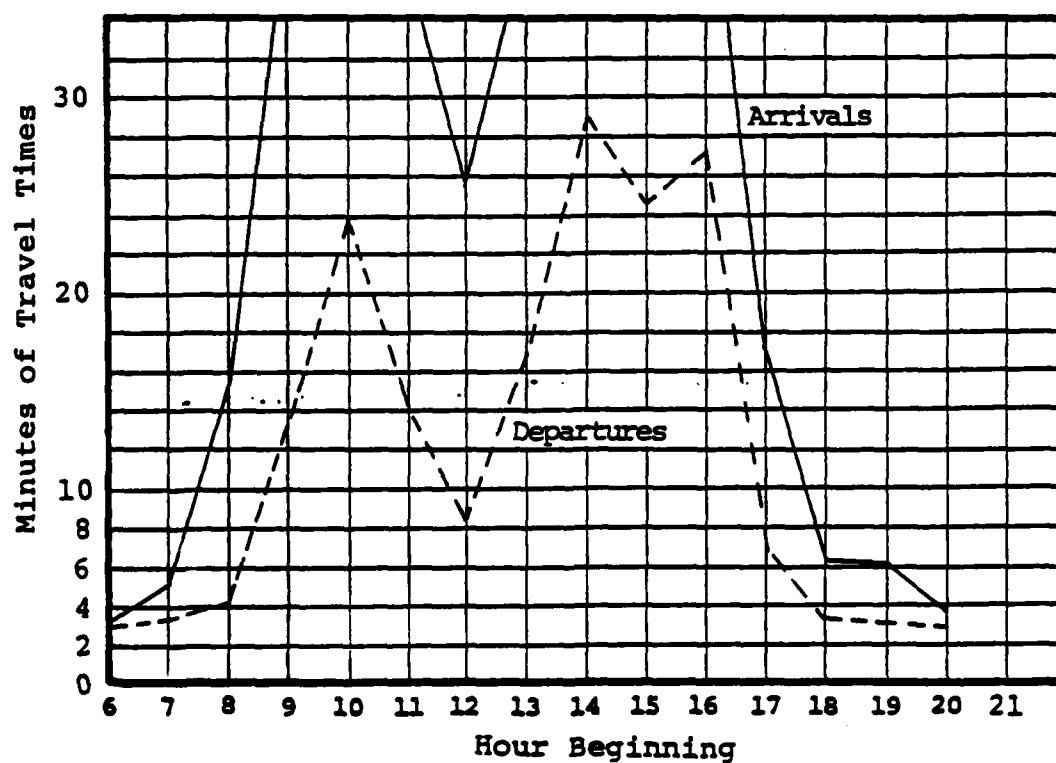


FIGURE (20A)C AVERAGE TAXIWAY DELAYS



FIGURE(20A)DAVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 21

Objective:

To obtain 1982 baseline delay estimates for the following runway use in IFR1 weather:

<u>Arrival Runways</u>	<u>Departure Runways</u>
28R	28L

Related Comparison Experiments:

Experiment 5 is the baseline case for 1977.

Results:

Figure 21A shows that total aircraft flows vary from 21 to 74 aircraft per hour over the 15-hour simulation run. The peak hour is from 0900 to 1000 hours and contains 23 arrival aircraft and 51 departure aircraft.

Figure 21B shows that average delays to aircraft using the runways are as high as 60+ minutes per aircraft. Peak-hour average delays are 60+ minutes for arrival aircraft and 14.6 minutes for departure aircraft.

Figure 21C shows that the peak-period average delays to aircraft using the taxiways are 0.2 minutes for taxi-in operations and 0.5 minutes for taxi-out operations.

Figure 21D shows that average aircraft taxi travel times vary from 3.2 to 19.6 minutes. Peak-hour average taxi travel times are 8.0 minutes for arrival aircraft and 19.6 minutes for departure aircraft.

FIGURE 21A AVERAGE RUNWAY FLOW RATES

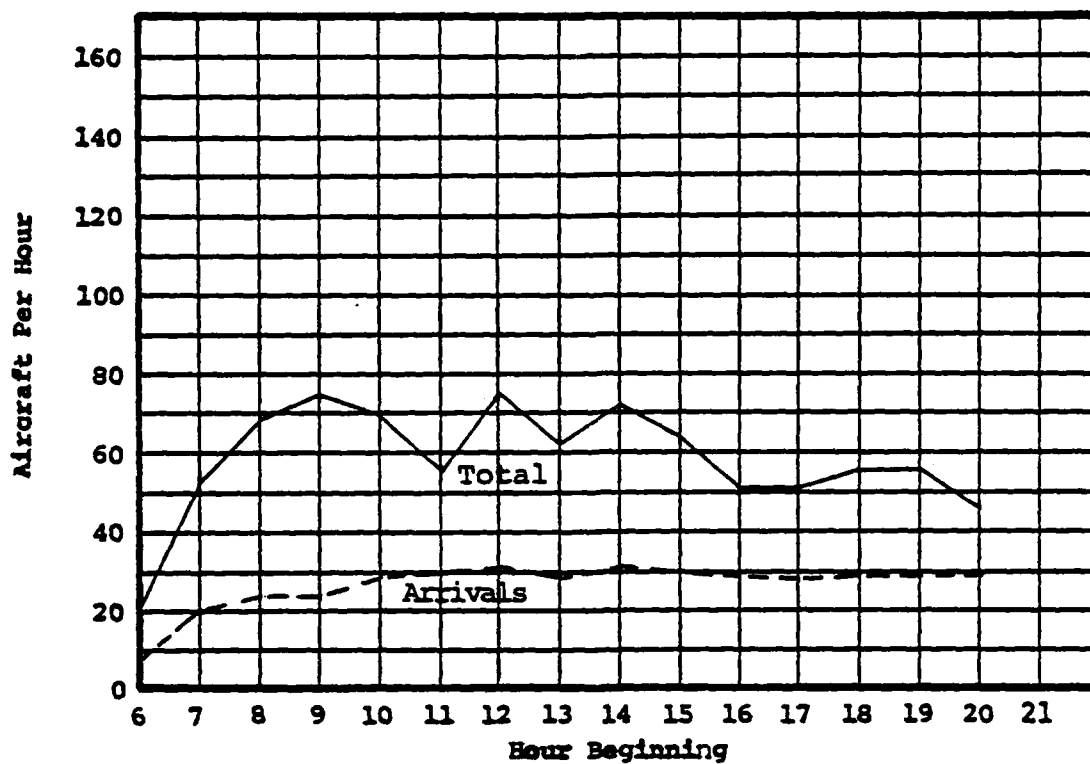


FIGURE 21B AVERAGE RUNWAY DELAYS

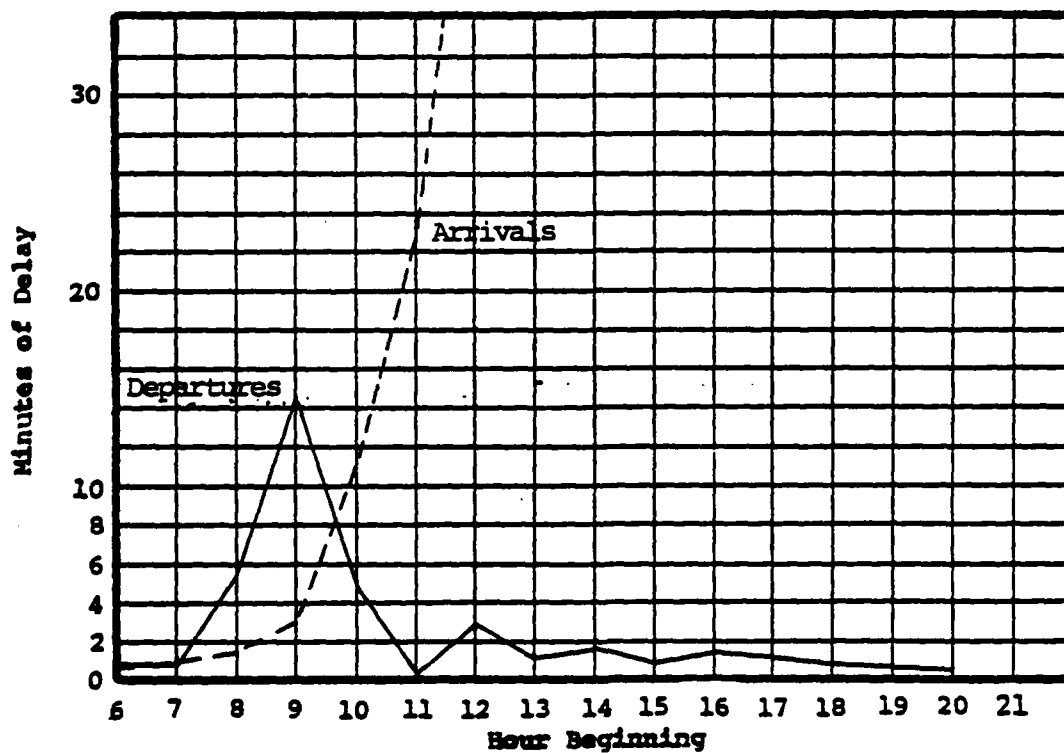


FIGURE 21C AVERAGE TAXIWAY DELAYS

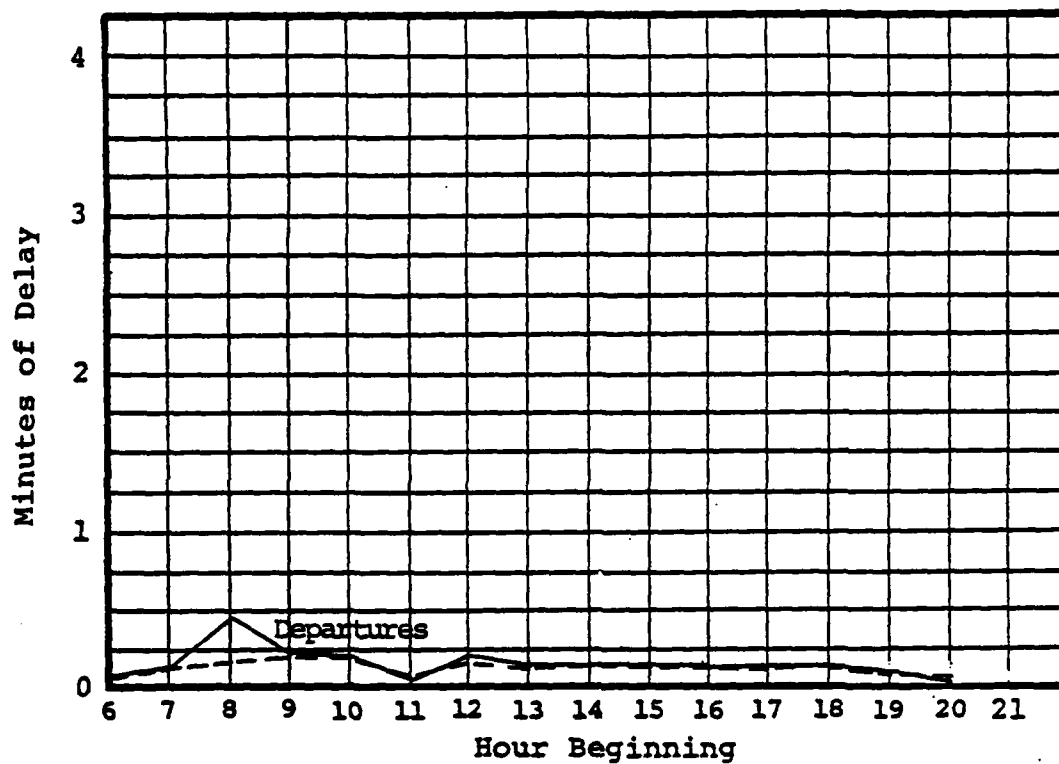
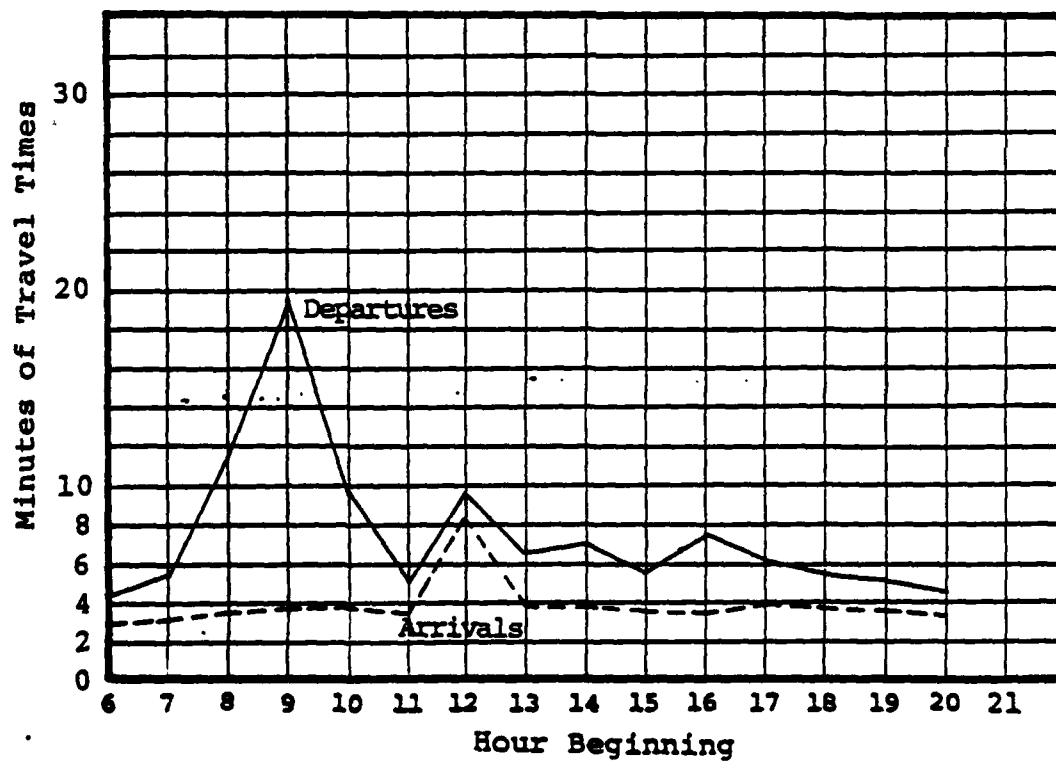


FIGURE 21D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 22

Objective:

To obtain 1982 baseline delay estimates for the following runway use in VFR1 weather:

Arrival Runways

19L, 19R

Departure Runways

10L, 10R, 19R

Related Comparison Experiments:

Experiment 6 is the baseline case for 1977.

Results:

Figure 22A shows that total aircraft flows vary from 22 to 85 aircraft per hour over the 15-hour simulation run. The peak hour is from 1200 to 1300 hours and contains 38 arrival aircraft and 47 departure aircraft.

Figure 22B shows that average delays to aircraft using the runways are as high as 5.4 minutes per aircraft. Peak-hour average delays are 1.9 minutes for arrival aircraft and 5.4 minutes for departure aircraft.

Figure 22C shows that the peak-period average delays to aircraft using the taxiways are 0.4 minutes for taxi-in operations and 0.4 minutes for taxi-out operations.

Figure 22D shows that average aircraft taxi travel times vary from 3.2 to 9.5 minutes. Peak-hour average taxi travel times are 3.7 minutes for arrival aircraft and 9.5 minutes for departure aircraft.

FIGURE 22A AVERAGE RUNWAY FLOW RATES

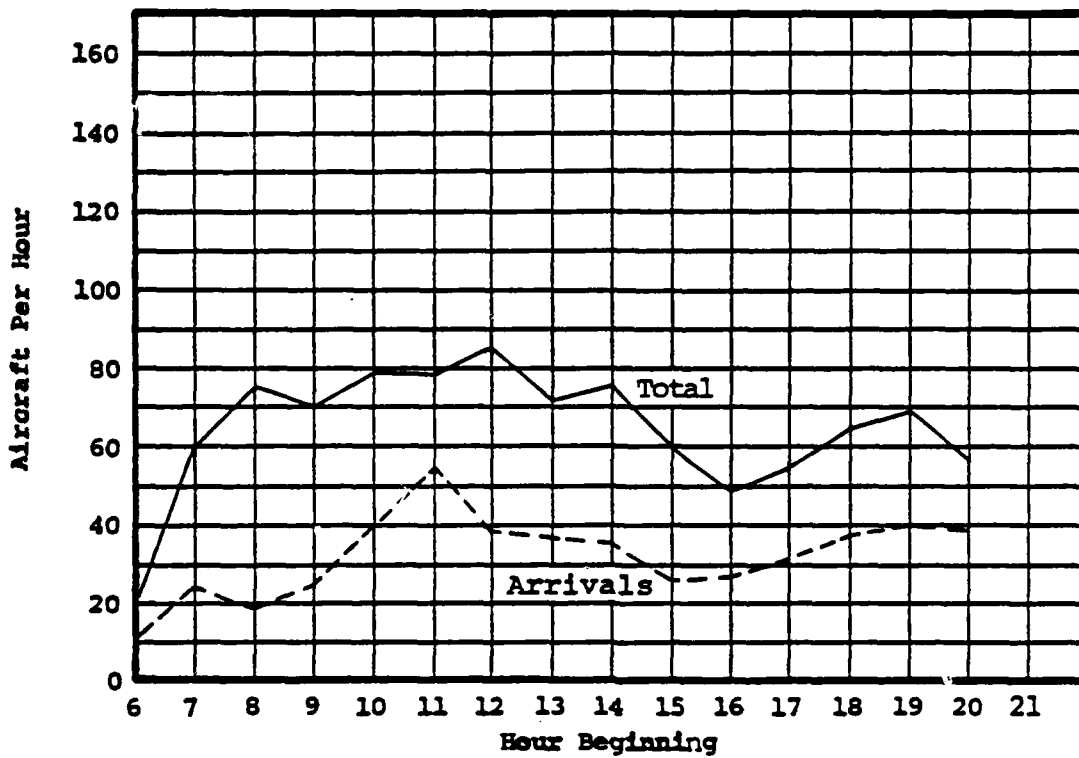


FIGURE 22B AVERAGE RUNWAY DELAYS

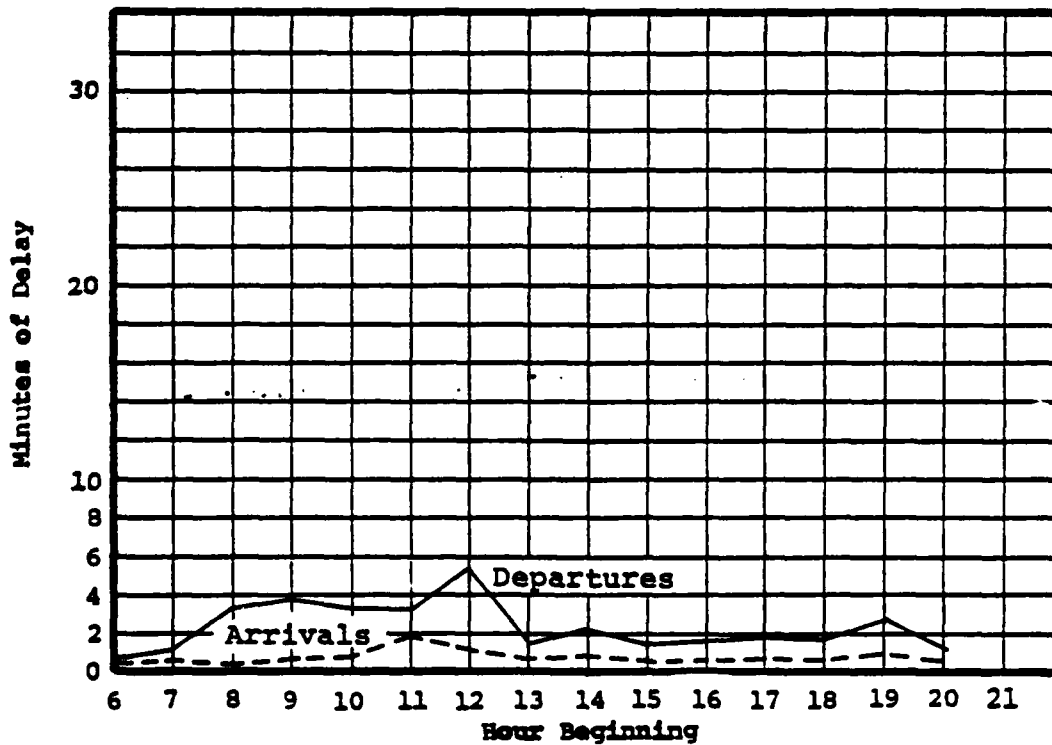


FIGURE 22C AVERAGE TAXIWAY DELAYS

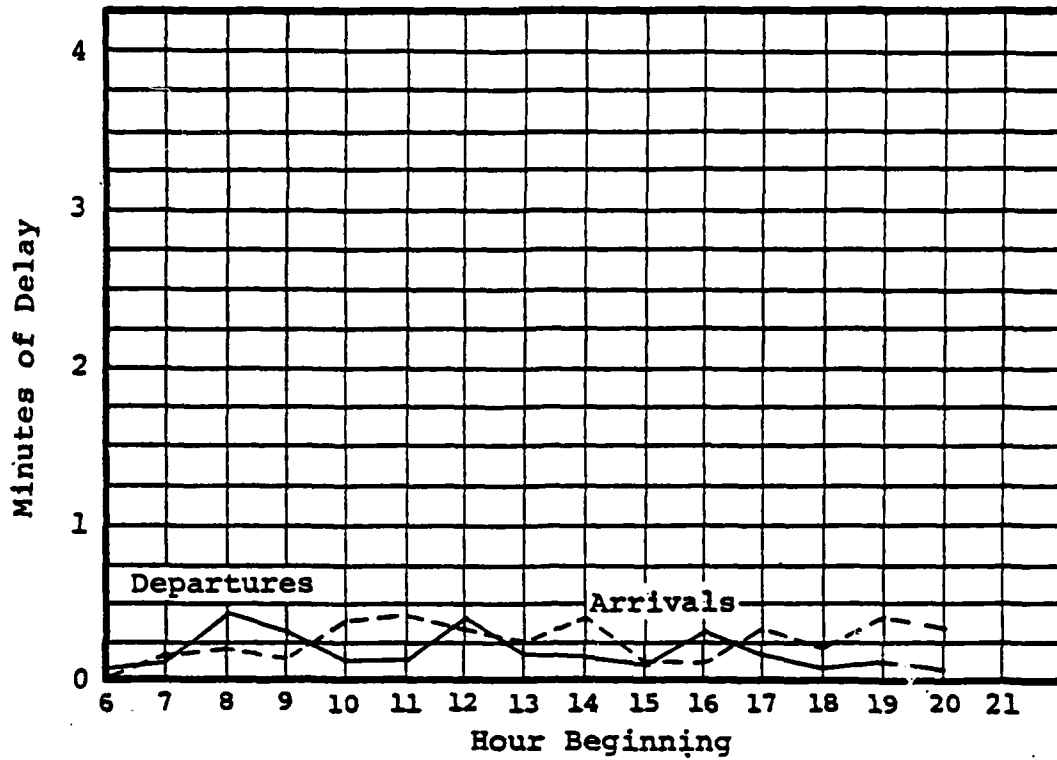
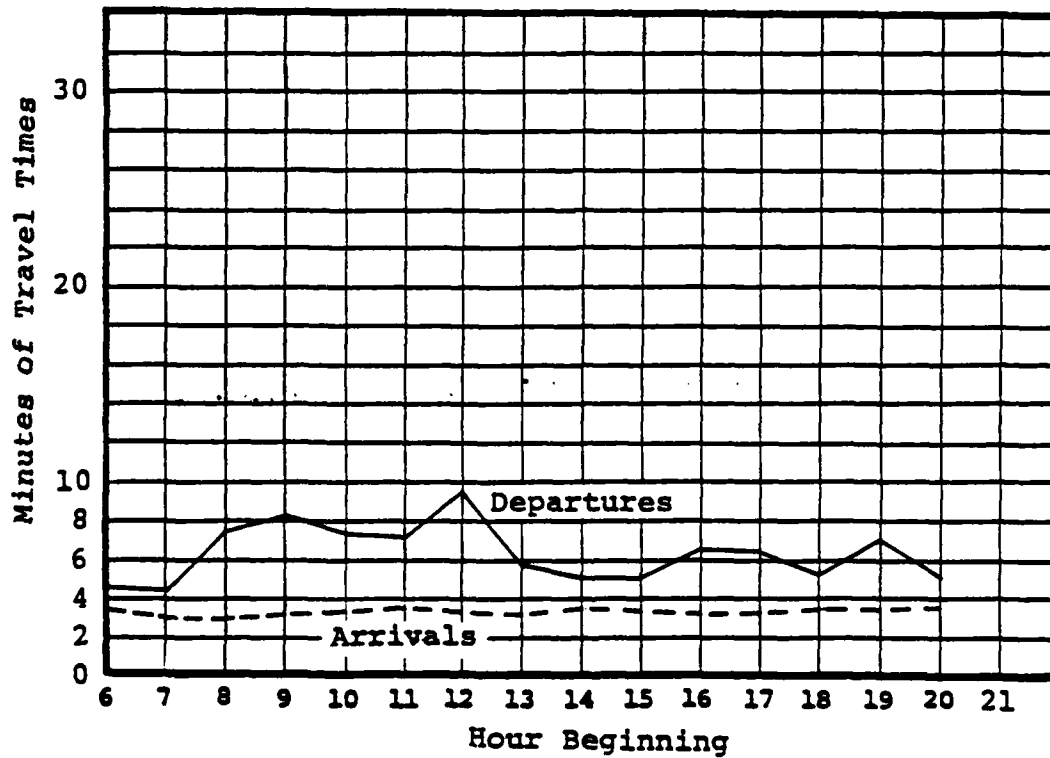


FIGURE 22D AVERAGE TAXIWAY TRAVEL TIMES



Experiment No. 23

Objective:

To obtain 1982 baseline delay estimates for the following runway use in IFR2 weather:

Arrival Runways

19L

Departure Runways

19L, 19R

Related Comparison Experiments:

Experiment 9 is the baseline case for 1977.

Results:

Figure 23A shows that total aircraft flows vary from 14 to 60 aircraft per hour over the 7-hour simulation run. The peak hour is from 0800 to 0900 hours and contains 20 arrival aircraft and 40 departure aircraft.

Figure 23B shows that average delays to aircraft using the runways are as high as 60+ minutes per aircraft. Peak-hour average delays are 25.4 minutes for arrival aircraft and 60+ minutes for departure aircraft.

Figure 23C shows that the peak-period average delays to aircraft using the taxiways are 28.3 minutes for taxi-in operations and 60+ minutes for taxi-out operations.

Figure 23D shows that average aircraft taxi travel times vary from 3.2 to 60+ minutes. Peak-hour average taxi travel times are 4.4 minutes for arrival aircraft and 60+ minutes for departure aircraft.

FIGURE 23A AVERAGE RUNWAY FLOW RATES

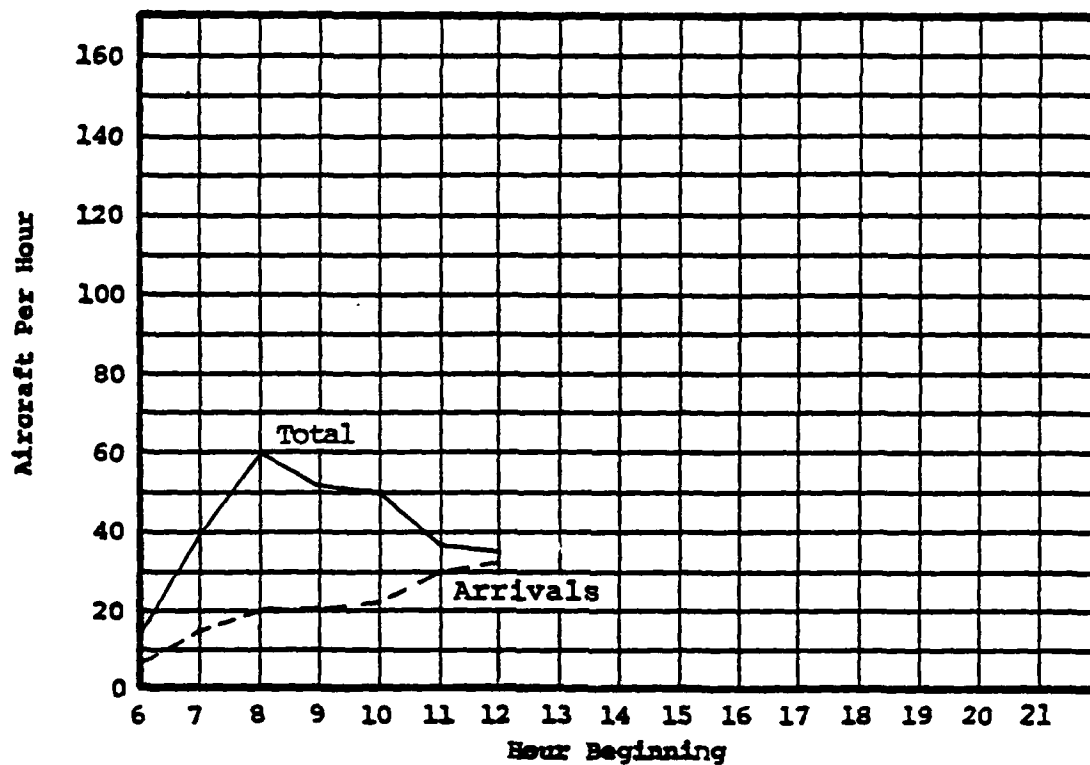


FIGURE 23B AVERAGE RUNWAY DELAYS

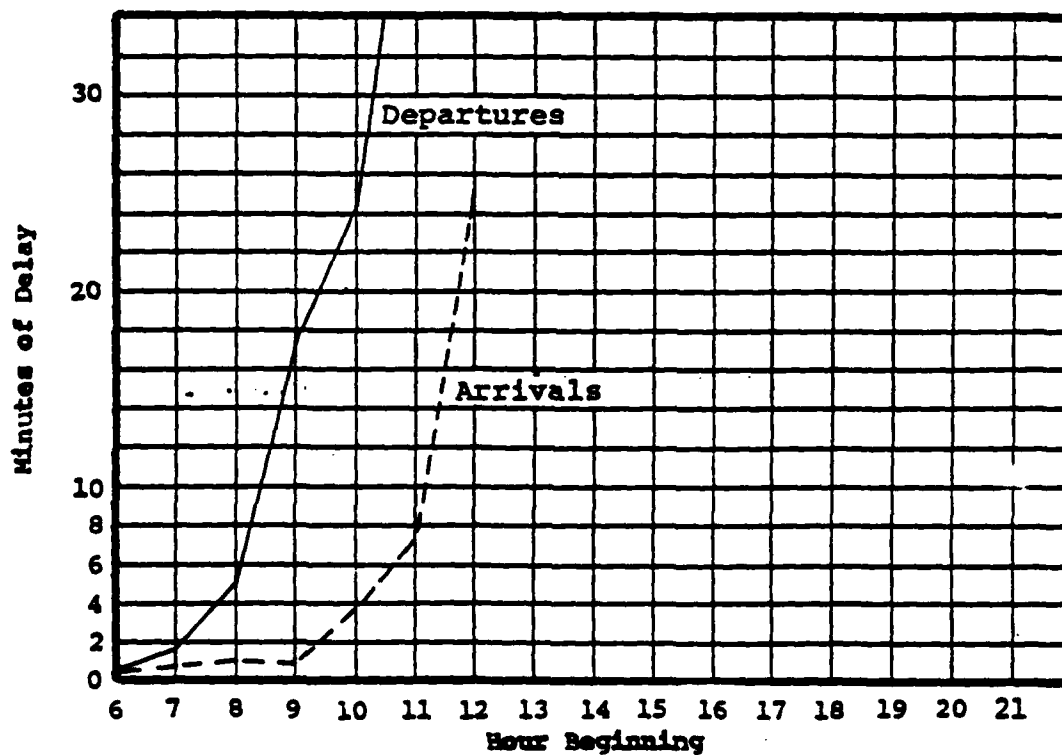


FIGURE 23C AVERAGE TAXIWAY DELAYS

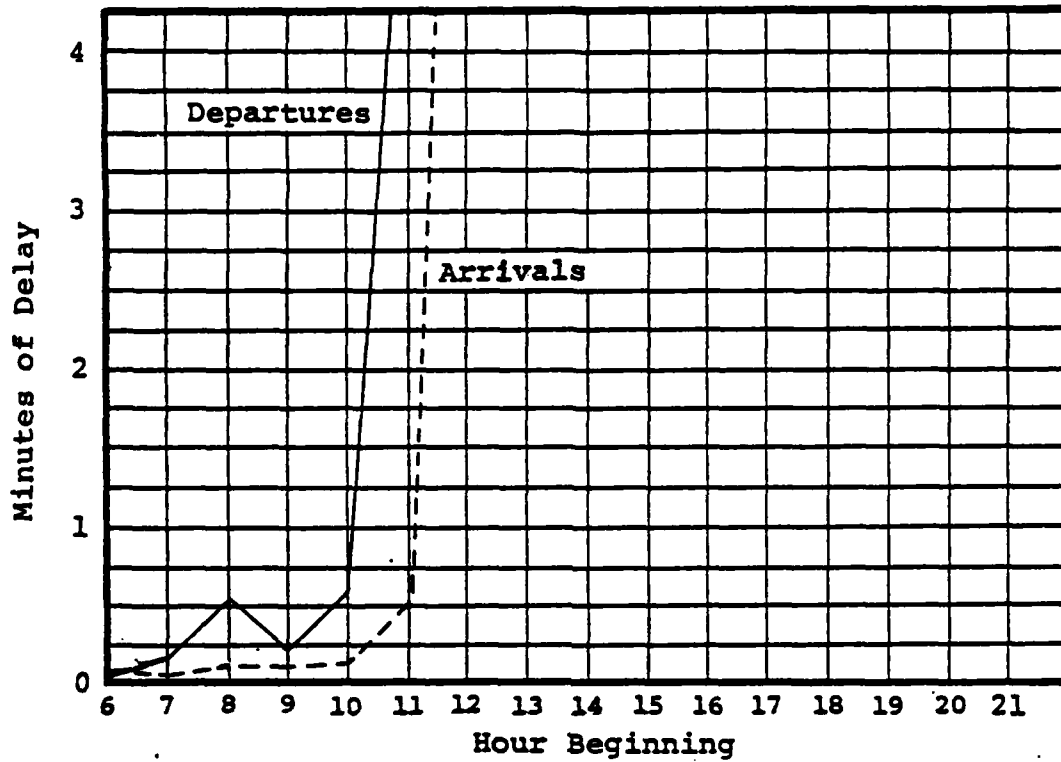


FIGURE 23D AVERAGE TAXIWAY TRAVEL TIMES

